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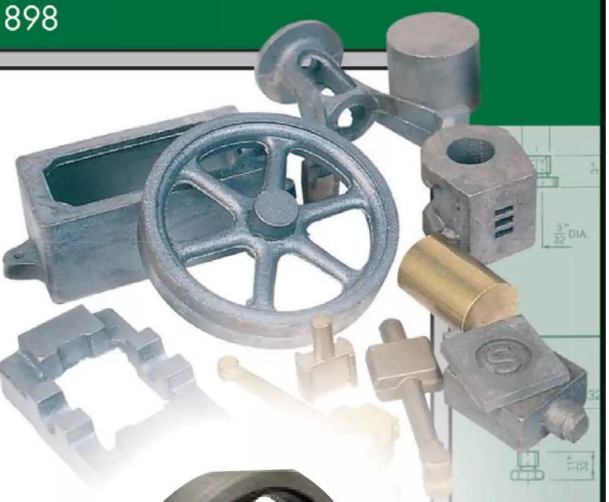

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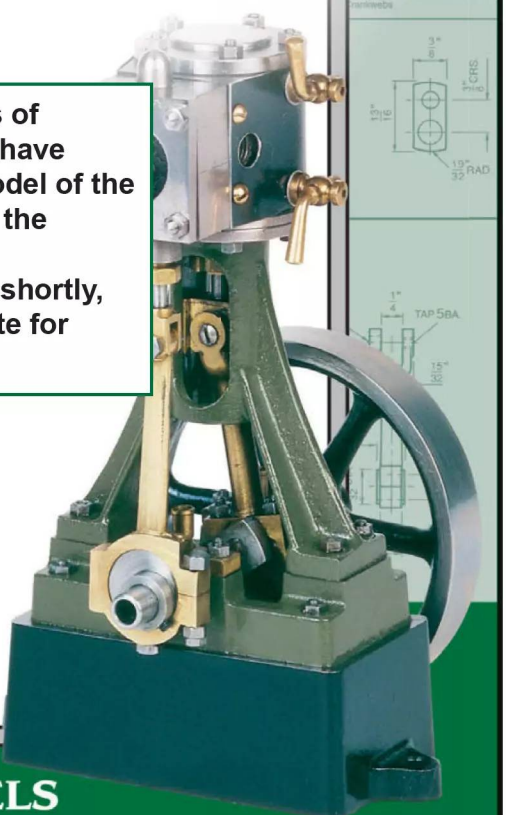

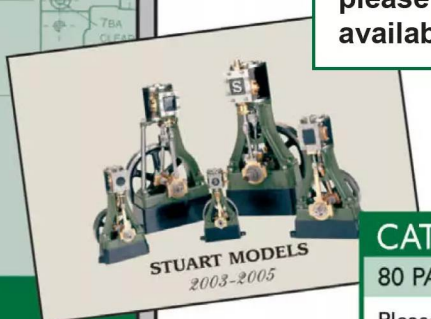

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CONTENTS

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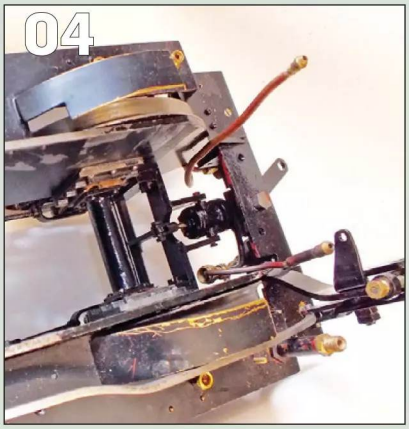
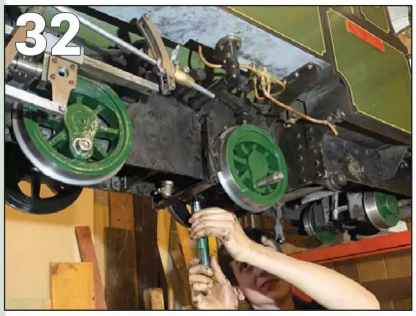
MARCH 2024 Volume 45 Number 09





FRONT COVER

Martin Johnson has spent 13 years building his 7-inch scale Fowler lorry and is now enjoying the fruits of his labours, here at a local steam rally with only the signwriting to finish. Martin concludes his build story in this issue.

Photo: P. Johnson

EDITORIAL

Repairing the throwaway culture of today's society

Welcome to the March edition of EIM, an important month for much of the model engineering community as Easter falls in it this year and several tracks awaken from their winter slumbers.

Mind you as I write these words it's the end of January and the weather is vile outside, again, so I've been staying warm and watching an episode of *The Repair Shop* on TV. Many readers will be familiar with this particular programme as it is rather satisfying, the basic premise being that people bring their broken or generally derelict family heirlooms to a barn full of highly skilled craftspeople who then bring said items back to life – an incredible range of items from pictures, vases and cuddly toys to model engines, watches, bicycles, you name it.

This programme started off as afternoon viewing fare but so quickly shone above the typical oh-so bland daytime output that it was given a prime-time spot, 8pm on a Wednesday night on BBC1, plus various repeats in the afternoons. Exposed to evening viewers it has proven to be one of the most popular programmes on the box – hopefully this popularity indicates that people are just beginning to realise that making and mending things is so much better than the "throw it away and buy another" society of recent times.

There's no doubting Martin Johnson likes making things – he has spent some 13 years dedicated to his 7-inch Fowler lorry project, learning a whole lot of new techniques along the way. He concludes his description of the build in this issue, and he should be rightly proud of what our cover shows is a superb miniature, which should give him many years of pleasure.

Innovation in making things is good too, and fulfilling that brief this month is Julian Harrison. He wanted a riding car to run behind his 5-inch gauge locos, but one that could be used on both raised and ground-level track, and which did not take up loads of space in his workshop when not in use. Julian begins to tell us how he achieved his aims in this issue, describing just the kind of clever design we like to see in our pages. Enjoy your EIM.

Andrew Charman

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An improved Schools – building a Roedean

In the latest episode of his 3½-inch gauge Southern locomotive project Nick spends some time in the cab, with some useful full-size inspiration.

BY **NICK FEAST** Part Thirteen of a short series

Anyone who builds a Schools-class model should know they are taking on a long-term project even in 3½-inch gauge. Even though someone else had done some of the work on mine to a pretty good engineering standard when I bought the model, it took four years of regular spare-time work to get it to the stage that I could steam it in October 2023. I also saved time by purchasing as many laser-cut parts as possible.

Workshop hours were extended as a result of Covid lockdowns so if contemplating such a model you will be making a big investment in time, not to mention the increasing price of parts, materials and the operating costs of your workshop. Looking back into the archives I found an article in *Model Engineer* describing the build of a Schools-class loco in the 1950s which took seven years and around 3,500 hours of work!

Plenty of information

The Schools was a much-photographed class of locomotive over the years and of course there are the three operable survivors as well as a vast amount of information now available via the internet. You should be able to find enough information to build a specific locomotive if you wish; my locomotive is not a model of any particular member of the class, more of a 'generic' creation, but later in the series I intend to detail some of the variations over the class to assist anyone wanting to build a particular member or to portray a particular era.

I had noticed that the rear axle bearings on my Q1 wore out more rapidly than the middle and leading ones. I surmised there were two factors at work. Firstly the rear axleboxes are right next to the ashpan so must get pretty hot even before the engine has turned a wheel, which is not really very good for lubrication. Secondly the movement of the loco on the track shakes up the ashpan and no doubt some of the ash finds its way onto the bearing surfaces that are of course open to the atmosphere (Photo 110).

This was also a problem on full-sized steam, and one of the ways to alleviate the problem was to fit metal dust shields such as the ones shown in Photo 111. BR Standards with narrow fireboxes often had these; no doubt other engines had them too.

The problem in using them on a model, at least in 3½-inch gauge is the usual lack of room – there needs to be enough clearance each side of the ashpan to fit them in. These shields will not only protect the axle bearing but also the horngide surfaces.

The other option is to make a canon-box axle assembly, whereby a metal tube rigidly joins the axleboxes. I had planned to do this from the start so made the necessary allowances when making up the ashpan.

Photo 112 shows a drilling jig clamped to one of the axlebox ▶

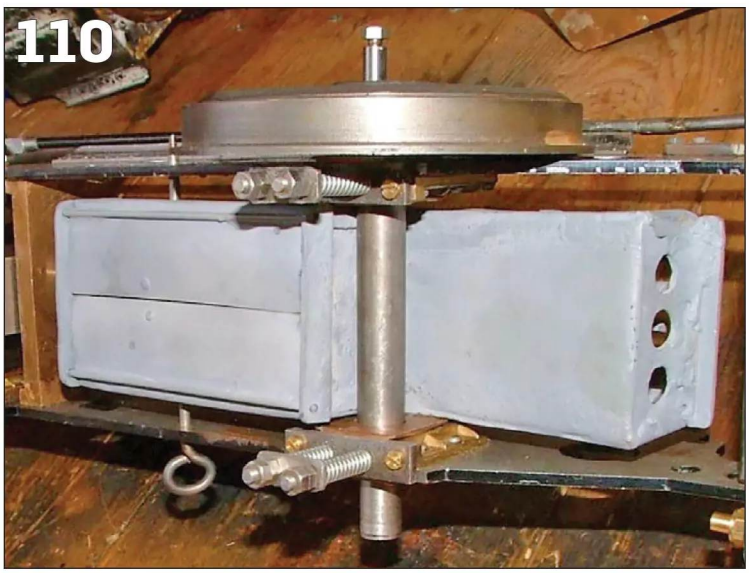


PHOTO 110: The ashpan and axleboxes sit very close to each other on this loco, the Q1 tank version described a few months ago. On the Schools model Nick narrowed the ashpan to allow enough clearance to shied the bearings from the heat and dirt.

PHOTO 111: These shields are simple to make and are bolted to the frames around the rear axles. The tops are closed to prevent dirt and dust dropping down on to the bearing surfaces.

Photos by the author

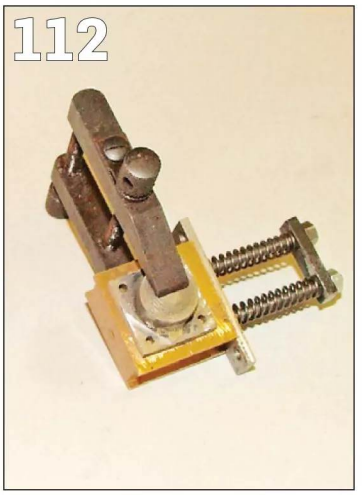
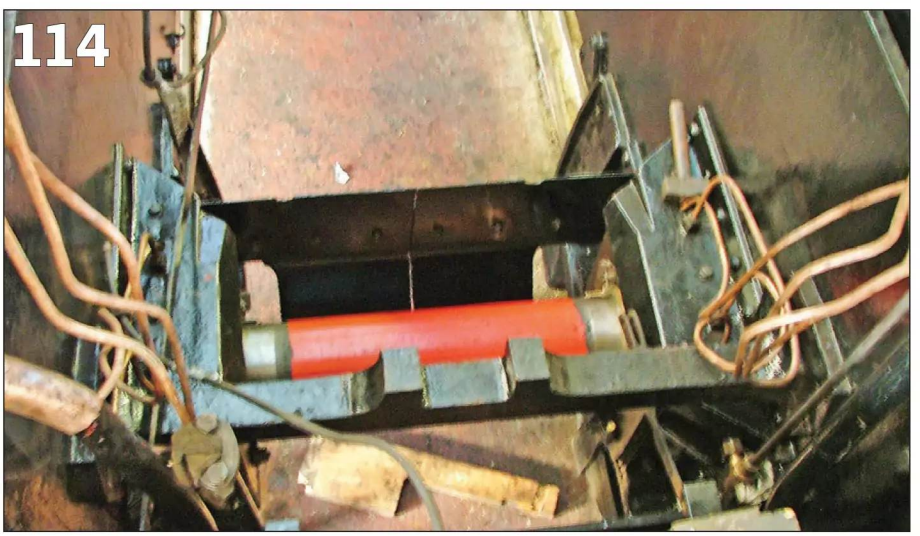


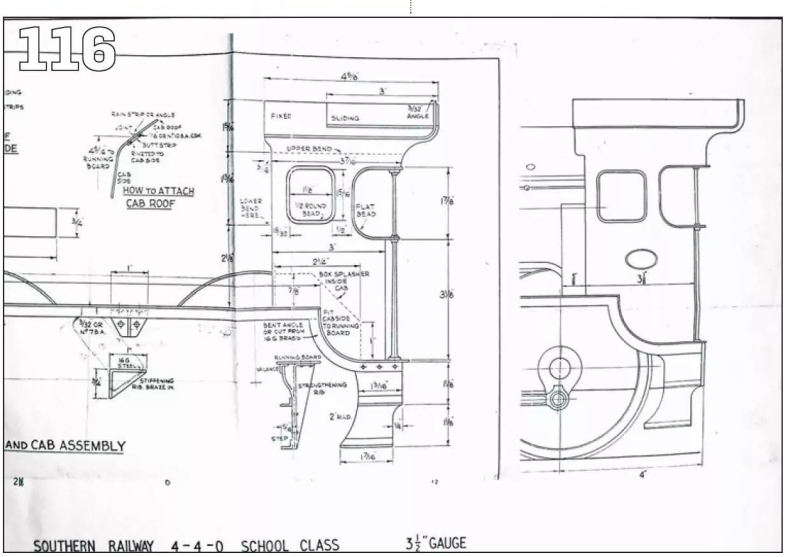
PHOTO 112: The drilling jig is clamped in place for drilling and tapping the axlebox.

PHOTO 113: The completed canon-box axle tube assembly installed in the loco, as seen from above.

PHOTO 114: 'Cheltenham' is not fitted with a canon-box axle but there are clearly dust shields in place above the horn guides.

PHOTO 115: The canon box casing and the steam brake cylinder can be seen, and the modification to the brake rodding mentioned in an earlier article.





assemblies. This jig will be used to drill the tapped holes in the axleboxes and the plain holes in the square plates fixed to each end of the canon-box tube. Steel or brass is suitable for the components of the tube assembly, while one should use steel for the drilling jig.

Photo 113 shows the axle in situ looking down from above – the damaged paint bears witness to many trial fittings of the boiler. Photo 114 is the same view on the full-size engine. There is a substantial stretcher between the axleboxes not included in the model, sheet steel guards over the tops of the hornguides and a steel plate across the frames presumably to act as a deflector for any ash that falls out of the ashpan when the rear damper door is open. There is also plenty of oil pipework visible along with the railway fitter's favourite, the 4lb lump hammer.

Photo 115 shows the same thing from a slightly different angle, note the full-width frame stay and support for the steam brake cylinder and modifications needed to the brake pull rods to avoid clashing with the springing of the main axles. Fortunately on this design there are no brake rods along the centre of the engine under the ashpan so nothing to impede the working of the hopper ashpan and drop grate.

If the canon-box tube is filled with high melting-point grease during assembly then your rear axle bearings should be happy for many hours of track use.

On a plate

There is a fair amount of sheet metal work to do on the loco and this can be brass or steel sheet. The laser-cut parts are in brass and have the advantage of being much easier to solder than steel, and there is plenty of joining to do. The LBSC drawings are excellent and

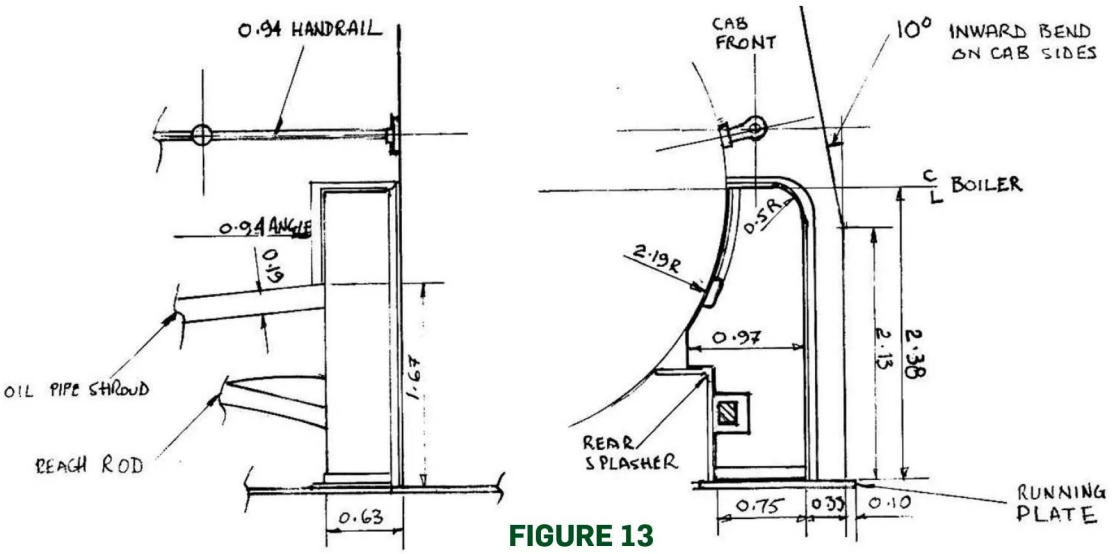


FIGURE 13
Detail of Schools-class reverser casing
Drawing not to scale, use dimensions

PHOTO 116: The LBSC drawing is on the left, with far more detail on how to do it. The Clarkson cab design with lower cab side windows was correct for the first batch of engines until they were altered, within the first few years of operation.

PHOTO 117: Eastleigh works never looked this neat in steam days! Some 75 years after its construction Cheltenham is restored in its home works.

PHOTO 118: This view of the inside of the driver's side of the cab shows the reversing wheel and the vacuum brake pipe. The bronze valve near the floor is the reversing shaft clutch valve.

PHOTO 119: Looking at the fireman's side we can see the rudimentary seat and the handwheel for regulating the water supply to the exhaust steam injector, which is located directly under the cab. The lever below it is the sanding control. Note also the ashpan damper controls on the floor.

show you how to do all of it, (Photo 116), and are also very true to the prototype appearance. The Clarkson drawings do not detail the platework at all; they show the original version of the cab as built for the first batch of locos in 1930 – this version of the cab with low windows and side lookout was modified very soon after the introduction of the class and the remainder were built as shown in the LBSC plans.

The cab footsteps are drawn with the incorrect profile on the Clarkson drawings whereas the LBSC version matches the curve of the coupled wheel, which is correct. The Clarkson drawings do, however, show the profile of the small housing on the front of the driver's side of the cab that I assume was added to cover part of the reverser mechanism (Figure 13). This is completely absent from the LBSC drawing.

I only made a few changes from LBSC's plans to suit my particular loco. Instead of splitting the cab front plate vertically down the centre line, as on the full-size loco, I opted to make it as one piece.

One is enough

Photo 117 is an interesting view of the last overhaul of 'Cheltenham' at Eastleigh, with London Underground stock and a Class 66 also in for attention. The cab front sheet is formed of several pieces – I decided that for strength I would use the one-piece laser-cut profile as supplied. I needed to make a fairly large semicircular opening at the top to clear the steam pipe to the manifold so this section was reinforced with a doubling plate.

The end result is a cab assembly that can be removed in one piece including the roof, with the minimum ▶

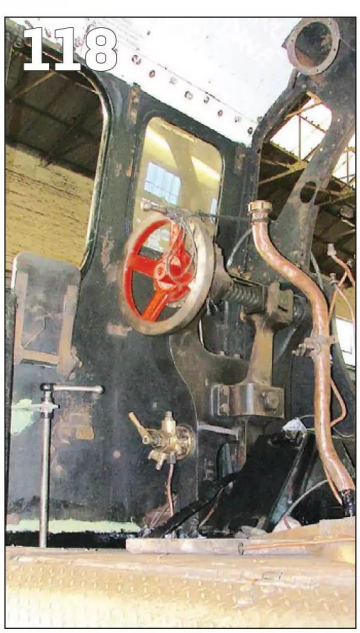


PHOTO 120: Points to note in this view are the angled cab sides to suit the limited clearances on the Hastings line, the lack of any cab roof ventilator and the profile of the front splasher to take the loco's nameplate – no separate brackets were required.

PHOTO 121: A superb 5-inch gauge model of a Schools by Paul Warrington which appears to be correct in every detail.

PHOTO 122: The addition of boiler lagging has meant that the cab and boiler are fighting for space. The cab side windows were blacked out with steel covers during wartime operations and a canvas blackout sheet added between engine and tender.

number of fastenings. I have included a few views showing the cab details (Photo 118-120) – these are difficult to obtain when the loco is in use.

Devil in the detail

Photo 121 shows Paul Norrington's prize-winning 5-inch gauge Schools loco exhibited at the 2022 Midlands show. It is painted in the dark green Maunsell livery that the full-size engine would have had when new. There is a lot of useful detail here which as far as I can tell is authentic and shows what can be done in the larger scales.

The steam valves in front of the cab feed the live-steam injectors via the distinctive copper feed pipes, which are different on each side of the loco. The one shown is the driver's side and has to avoid both the handrail and the large ejector pipe, so has a more complex shape than its partner on the other side that only has the handrail to contend with.

Photo 122 is the same view of my loco. The main difference is the cover hiding my oversize steam manifold pipe, which I have modelled on the type of shroud fitted to the Q1. The pipes are dummies as the actual injector plumbing is routed through the cab.

My loco will be in wartime black livery, in which almost everything is black. Even the BR lined-black livery in which the Schools class were painted until at least 1957 specified black for the whole job except the buffer beams and inside the front frames, which were red. The only polished items were the safety valves and the whistle, and possibly the reach rod as shown here.

The ejector vacuum pipe has become the blower steam feed and is lagged; I use whipping cord in the hope that some heat will be retained. I have not added the small angle sections to the cab extension over the reverser, it could be added at a later date. Still left to do is a piece to finish the boiler cladding to cab front join. Note there is a curved sheet between the splashers, which hides the boiler support angle and nicely tidies up the boiler to side platform join.

We still have some work to do in the cab area – next time I will show how I fitted the lifting cab roof and detailed the footplate. EIM

■ Parts one to 12 of this series appeared in the February to August and October to December 2023, and the January and February 2024 editions of EIM. To download digital back issues or order printed copies go to the website www.world-of-railways.co.uk/store/back-issues/engineering-in-miniature or call 01778 392484.

Building a large-scale Fowler Steam Lorry

Martin concludes the story of his 7-inch scale road engine build, building the body and then enjoying the fruits of 13 years of dedication to his project.

BY **MARTIN JOHNSON** Part Nine of nine

In the most recent episode of this series I had mostly completed the steam-propulsion machinery for my 7-inch scale Fowler steam lorry but the cab bodywork needed finishing. One of the most conspicuous panels on a steam lorry is the front of the cab and the Fowler is quite distinctive as shown in **Photo 125**.

Reproducing that double curvature was not going to be easy. I initially considered getting it done professionally, but a chat with my friend Pete suggested that beating over a former would be a reliable method. So the next problem was making a former which I built up from 6 x 2-inch timber reclaimed from a garden project.

Layer by layer

The timber was cut so the grain followed the cab front profile and then routed to shape using a profile template. Each layer was screwed and glued to the one below and then routed before the next could be laid on as two inches is about the maximum reach for a router. Each layer was kept in line by drilling dowel holes through each successive layer to locate the template, which needed an extended drill 12 inches long to go through all six layers (**Photo 126**).

A total of six layers of boards were built up with the top three layers being routed to a stepped profile to provide the rough form for the compound curve of the cab front. For the compound curved section, the routing template was moved back 10mm at each step, which was achieved by drilling a series of holes in the template at 10mm intervals. These holes then located on dowels which registered in the two holes drilled right through the 12-inch stack of timber. The depth of rout for each step was determined from the CAD. The first three layers are vertical-sided so I could clamp the work down with a ratchet strap to beat the curved section over the former (**Photo 127**).

Next, all the steps were planed back to just leave a witness of the step. The former was then laid on a frame, which aids registration of the sheet metal onto the former. There then followed quite a lot more planing back and sanding down. Next came the body filler and then more sanding... (**Photo 128**).

"One of the most conspicuous panels on a steam lorry is the front of the cab and the Fowler is quite distinctive..."

I chose 2mm aluminium sheet for the cab front sheet and it needed a 1 x 2-metre sheet, which is quite expensive once shipped to the Scottish Highlands. So it was with some trepidation that a start was made by routing out the basic outline with yet more formers. Then it was off to Pete again to put it through his rollers to produce the form shown in **Photo 129**. ▶

PHOTO 125: Photo of the full-size lorry showing the distinctive shape of the cab.

PHOTO 126: First two layers of cab former during routing.

PHOTO 127: Cab former built up and rough-routed to shape.

Photos by the author

PHOTO 128: Cab former complete but for more sanding and filling.

PHOTO 129: Cab front cut to outline and rolled to a rough shape.

PHOTO 130: Front part-way through beating over former.

Fortunately, the sheet, had enough height that if the first attempt at forming went wrong I could cut off up to 200mm and try again. As it turned out, I did not need to.

The part-formed sheet was then annealed along the top 200mm and then screwed and strapped onto the former, making sure the sheet was centred on the former and at the right place in relation to the required curve. A wood-screw at each corner made sure the work went back on the former in the same place after each annealing. Note the ratchet tie down straps with padding under the ratchets providing a firm hold on the sheet without marking it.

Photo 130 shows the front after the third cycle of annealing and beating. I show this to encourage anyone who has had trouble making boiler plates or similar. Several points to note about this sort of work;

1) Annealed aluminium is very soft – even a hide-faced hammer will mark it (don't ask). So don't hit it direct with a hammer – I used an old oak chair leg between the work and a 2lb hammer (Photo 131).

2) A big hammer used lightly is far better on this work than a small hammer used furiously. For that reason, the former needs to be substantial; there is 50 feet of timber in this one!

3) Anneal the work often. Don't keep hammering because you are impatient – that is a short-cut to disaster.

4) Aluminium can disappear into an expensive molten blob if you are careless with the annealing. You can see hatching in felt marker pen in Photo 132; this disappears at aluminium annealing temperature. I also used an infra-red thermometer on the reverse side to the blowlamp. These give false readings on shiny metals but I 'calibrated' it by melting some scrap and seeing what reading the instrument gave at melting point. That gave me an absolute upper limit to avoid at all costs. Some infra-red thermometers have an adjustment for object emissivity, but the value for aluminium sheet is not precise, so 'calibrate' seems the way forward.

5) Always work the wrinkles first. Start beating on the crests, to compress the metal toward the valleys. Once you have reduced the crests, you can give an overall working to the whole thing. It is probably time for another annealing by then!

6) As you progress, you will have more and more wrinkles but they will be smaller and smaller wrinkles.

It took a total of nine cycles of annealing and forming to get to the

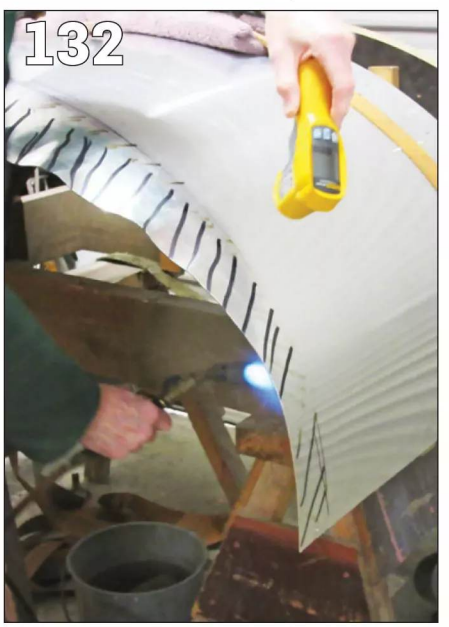


PHOTO 131: Technique for not marking the aluminium sheet – using a big hammer and oak chair leg.

PHOTO 132: Annealing – felt-tip marker just disappearing opposite flame, with infra-red thermometer to check temperature. *Two photos above by P.Johnson*

PHOTO 133: Cab front sheet finally formed.

PHOTO 134: Cab front trial fitted to trim off flush with door pillars.

PHOTO 135: Sawing 12mm brass into half-round sections.

PHOTO 136: Drilling & tapping guide to fix half-round beading.

stage that is shown in **Photo 133**. Abrasive paper, paint, filler and elbow grease will have to do the rest.

The formed cab front then needed trimming, the addition of fixing angles along the bottom and sides and trimming to get a neat fit to the door pillars as shown in **Photo 134**. The fixing angles to the door pillars needed some thought in the design because the cab front has to be easily removable for maintenance, but not prone to damaging the paintwork. This was done by using hidden Allen screws in the door pillars – open the doors, unscrew eight bolts and the cab front can be removed.

Keen-eyed readers will have noted from the first photo in this episode that the prototype had the cab sheet edged in half-round brass beading. In this scale, that equates to six metres of 12mm half-round brass; such a section is available but not at a price I was prepared to pay! I decided to saw 12mm round brass rod down the diameter and the set-up on the milling machine is shown in **Photo 135**. The rod is gripped in some wooden clamps and a slitting saw is run down the middle of the bar. The set-up really needed a third wooden support mid-way as well. I also had to temporarily move the milling machine to get sufficient space in the workshop for in-feed and out-feed, even after splitting the brass bar into two lengths.

Bending the half-round sections to fit round the cab front and doors took a lot of brute force, even after annealing the brass. Now I know why they call it hard brass!

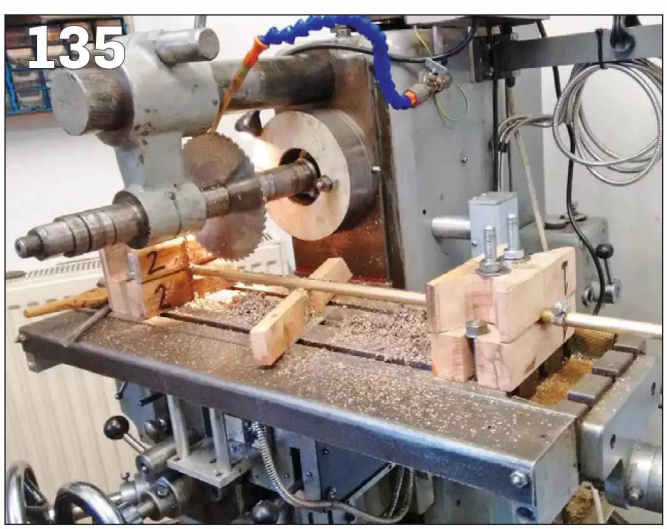
The half-round beading would probably have been riveted onto the panel in full size. I used screws to avoid accidental damage to the panels. The little guide shown in Photo 136 centres a tapping drill on the rod diameter, then a change of bush gives a tapping guide. With 50 or so holes or one every 120mm, every convenience counts. The hardwood jig (**Photo 136**) was perfectly adequate for the job. The screws go right through the beading from the inside and the excess tails were carefully dressed off with a small file.

Photo 137 shows the cab front in primer with the half-round beading fitted. I notice from my records that the cab front took about eight months of work in making formers, beating the panel and fitting the beading. The work has paid off though.

Coal storage

The initial testing was completed with coal held in a Supalyx box (excellent freely available general storage if you live in the countryside!) balanced on top of the engine. With more intensive use on the horizon, a properly engineered solution was required.

I had been waiting for a couple of years for a local fabrication shop to make up something to my drawing without success, so I set to and made my own, bent up from 1.5mm steel sheet and pop-riveted together (**Photo 138**). The bending was done by clamping the sheet between two angle irons and then using a wood block and hammer to get a reasonable



bend without too many dents in it.

The pan sits on two wooden rails and hangs between the engine cylinders; it also has to miss a variety of brackets, levers and pipes so a template piece was cut that avoided all the intrusions. Photo 139 shows the finished coal pan in place between the cylinders.

Snagging & Rectification

In the last instalment, I mentioned a number of snagging items still needing attention. Top of the list was the regulator; I realised that under steam, the spindle was being pushed up as a piston. This is a problem when the closing force is provided by a spring which also has to return the pedal to its closed position; the steam force and spring force can never be properly balanced at varying boiler pressures. Increasing the spring tension makes the pedal harder to press at lower steam pressures.

My fix was to provide a balancing piston supplied with live steam, so that the piston force on the spindle could be opposed by the piston force from the balance piston. The modified regulator is shown in Photo 140 with the balance cylinder and steam supply on the right. The balance cylinder is forcing the beam anticlockwise about the pivot to balance force from the main spindle which forces the beam clockwise about the pivot. I made the balance cylinder about 20 per cent larger than necessary to bias the regulator closed for safety. The spring is still fitted to return the pedal to the closed position.

PHOTO 137: Finished front in primer with beading fitted.

PHOTO 138: Making the coal hopper. Sides are clamped at the correct distance apart so that the end panel can be marked to shape.

PHOTO 139: Coal pan in place between cylinders. The seats fit over the cylinders.

PHOTO 140: The modified regulator with balance cylinder at right.

Other problems were easier to fix:

1) The boiler needed a couple of 'boil ups' with washing soda to clear oily residue that was causing priming.

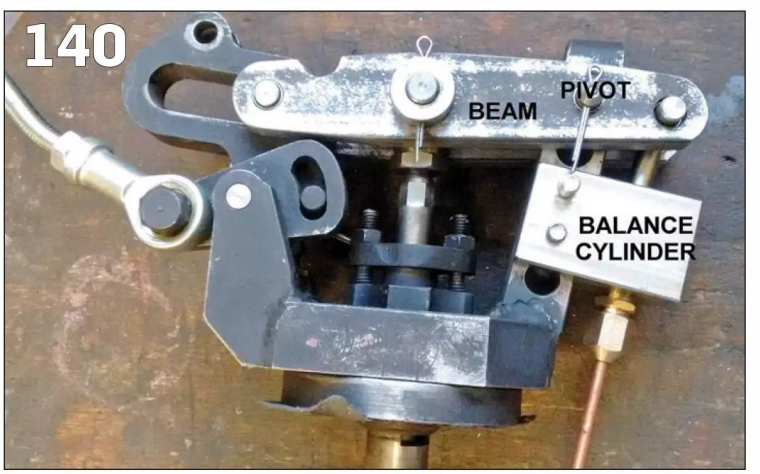
2) The whistle and some other controls operated by Bowden cable have stuck when heat has melted the nylon lining in the outer cable. In some cases this has been rectified by re-routing the cable away from the heat or replacing the outer cable with copper tube.

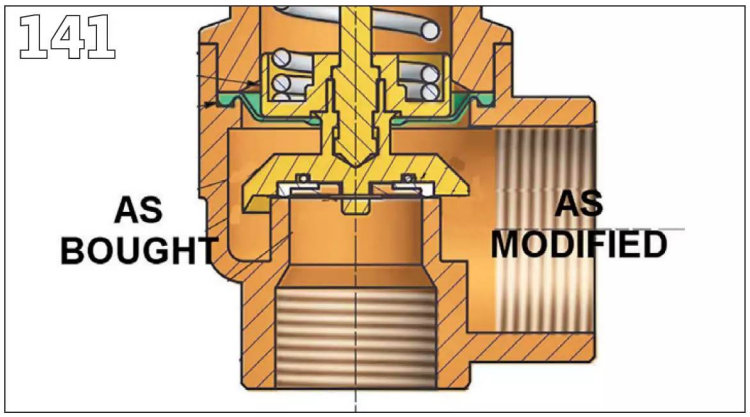
3) The injector was found to have a blocked overflow stemming from a manufacturing fault. That took some finding as the blockage still allowed some flow, so everything looked fine but it refused to pick up. Once I had identified the problem, I returned it to the supplier – the problem was rectified very promptly and it is now a very good injector.

4) I have had a bit of a battle with cylinder draincocks sticking open which was mainly due to insufficient clearance between spindle and body. After much dismantling and lapping down the spindles they seemed to be closing properly. Then just to keep me on my toes, one side fell victim to the melting Bowden cable syndrome, needing a bit more cable re-routing.

5) The safety valves were much too explosive on opening. This is what pop safety valves do, but they were frightening dogs and children (and me sometimes) which is not acceptable in public places. The means by which the commercial valves 'pop' is shown in Photo 141 where a skirt surrounds the valve faces shown on the left of the picture; as steam starts to escape, it hits the skirt and is deflected downward, creating an upward force on the valve spindle to rapidly open the valve.

I reasoned that the skirt would need machining back, but I did so in 0.25mm steps, trying the valves after each step just in case the open/shut range was increasing unduly as a result. I found that the open/shut range did not seem to be affected and the pop action finally ceased when the skirt had been fully machined away as shown on the right of photo 141.





I completely removed the skirt on one valve which I have set to lead the remaining pop valve. That way, I get a gentle progressive opening but if pressure continues to build the second pop valve quickly reduces any accumulation, keeping pressure well below the 10 per cent over pressure margin. That all sounds simple but with careful 'cut and try' took about six months to achieve.

6) Another problem associated with the safety valves was condensate filling the vertical exhaust pipe run from the valves. This was then violently ejected when the valves lifted, giving bystanders a free hot shower. A pair of small-bore drain pipes discharging condensate under the footplate sorted that problem.

Transport

The calendar moved on and a boiler test was looming; I needed to get transport sorted out. The original plan when I started the project was to tow the lorry on an A-frame but changes to regulations for trailer brakes and the prospect of trying to get the whole thing through the relevant Government test persuaded me that a trailer was a better bet. So a suitable secondhand 10 x 5ft flat-bed trailer was purchased.

The lorry already had provision for a winch which was arranged so that the lorry pulled itself onto the trailer so loading was quite simple. Even so, the technique of steering in reverse up ramps onto the trailer took a bit of learning!

The boiler test was on a dry but chilly spring morning at Lothian Model Road Steam Club headquarters. The lorry drew various admiring glances and perceptive comments such as "it's big, isn't it". I already had the British Engineering Services certificate for the twice working-pressure test on the pressure shell, so the remaining test was a good look round followed by one and a half times working pressure hydraulic on the whole assembly and each of the two superheaters. A brief pause to re-assemble safety valves and install the superheaters back into the boiler and we were ready to light a fire!

Steam was duly raised while grabbing a bite of lunch and then it was safety valve setting to the inspector's satisfaction. Finally, the steam accumulation test (easy with those pop valves!) and then a demonstration of the pump and injector and we were fit to go.

There is a well known bye-law that the inspector must be given the first run upon completion of a boiler test, and this was duly complied with following which anybody who was willing to risk it had a go.

Road Registration

Once I had a boiler certificate, I could complete the road registration with the licensing agency, which proved to be a straightforward task. The key when contacting the UK DVLA for this sort of vehicle is to ask for the 'Kits and rebuilds' section which deals with the weird and wonderful plus steam vehicles. I was given a full list of what I needed to provide and I simply worked through the instructions. A few weeks later, a registration form and number arrived in the post.

Tube sweeping

An aspect of operation that had not yet been addressed was boiler cleaning. Tube sweeping from under the lorry would be very awkward, while sweeping from above involves quite a bit of dismantling and the superheater coils are virtually inaccessible without removal from the boiler.

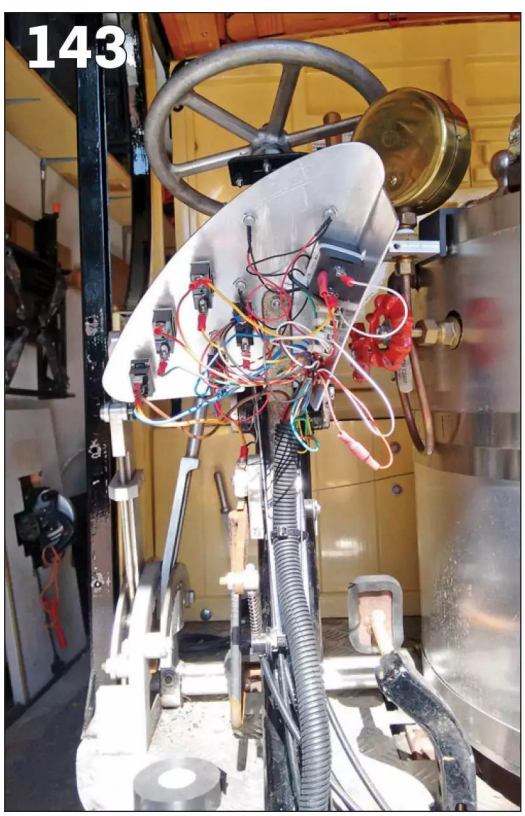
Sentinel lorries overcame the same problems with a steam lance, and so did I. A steam supply terminating in a coupling block mounted on the front chassis rail was installed and a length of ⅜-inch industrial steam cleaning hose plus swaged-on fittings was purchased from our local hydraulics service point. I made up a short length of pipe, a valve and nozzle and we were in business.

The method of use is to drop the fire, put the injector on and let ▶

PHOTO 141: Safety valve showing skirt for pop action on left and as machined back on right.

PHOTO 142: Steam cleaning the superheater coils through the stoke chute hole. *Photo by P. Johnson*

PHOTO 143: Wiring nearly complete on the steering column-mounted dashboard.



pressure die to between 50 to 100 psi while removing the four bolts securing the firing chute. Screw on the steam lance, open the valve then the tubes can be jetted out from below. Next take out the firing chute (use gloves because it will be hot!) and the superheater coils can be jetted through the hole in the boiler top. A bit of light blower helps to take the soot upward away from the operator. As **Photo 142** shows, this is not the most pleasant of jobs, but it seems to be effective.

Electrical system

I had decided from the outset that the lorry would have road-legal lights and rear-mounted warning beacons for safety. That demands an electrical system which is quite simple although the forest of wires around the steering column dashboard suggests otherwise. (**Photo 143**).

In addition to the lights and beacons, I have included an electronic boiler water-level monitor and remote indication that the steam pump and cylinder oil pump are working. The electronic water level shows 'high' (about two thirds on the glass) or 'low' level (about one third on the glass) and both pumps have a microswitch which pulses an LED at every stroke. The display of four LEDs is discreetly mounted on the fireman's side door pillar, but is very helpful since the driver cannot see the gauge glass, and is comforted by knowing that the pumps are doing something.

Lining out & signwriting

Part way through the painting, the biggest Scottish steam rally was due so we could not miss attending that, even though not all the panels had been varnished or signwritten. **Photo 144** shows me with the lorry in the ring. The weekend was topped off with receiving the cup for best working miniature at the show. However, that front apron was just begging for some lettering and lining!

"Each day of the project has cost £4.64 but I have enjoyed every minute so that is money well spent..."

PHOTO 144: On parade at the Bon Accord club rally. The sunroof has been opened. *Photo by P. Johnson*

PHOTO 145: The lining and signwriting part-done.

PHOTO 146: The official works photo.

Photo 145 shows the start of the lining and signwriting process. The lining was done with a home made lining wheel which will be the subject of a separate article, along with some observations on sign writing. The 'Caution Steam Brakes' notice was my introduction to DIY signwriting; not true of course but I just like the sign.

After the rally, it was back to lining, lettering and varnishing to finish just in time for our end-of-season rally. The lorry has been lettered and numbered for a vehicle that was sold from the Highland Show in Inverness to a sawmill in Conon Bridge, Ross-shire. **Photo 146** shows the lorry more or less finished at the Summerlee Heritage Park. There are always little jobs to tinker with and things to improve, but that basically completes the story.

The project has taken 13 years from concept to steaming, of which two years were taken in making over 30 sets of patterns. Considerable design work has been required along with the production of at least 350 engineering drawings. I have learnt about vehicle chassis design, braking and steering systems. I have learnt new skills including wood bending, canvas roof covering, sheet metal forming, tube forming and signwriting. Each day of the project has cost £4.64 but I have enjoyed every minute so that is money well spent. Thanks are due to Harry, Rod, Frank, Murray, Bob, Alan, David, Pete, Tim, Tony, Sandy and especially Penny for their help and encouragement along the way. EIM

■ Parts one to eight of this project appeared in the September and October 2018, March to May 2019, July 2020, February 2022 and March 2023 editions of EIM – to obtain printed or digital back numbers see page 8. You can also view the project online at bit.ly/3OdT3KJ

The author can also be contacted via the editor.

A little deja vu...

Our miniature railway engineer bravely demonstrates through experience that engineering is as much about thinking and planning, as actually doing...

BY **HARRY BILLMORE**

I arrived back into the workshop of the Fairbourne Miniature Railway after the Christmas and New Year break full of optimism and hope – this however was soon replaced by the more usual mutterings under the breath and cursing of my past self as the first job of the year was to sort out the drive train of our 12¼-inch gauge diesel hydraulic loco 'Gwril'.

This will be a tale of "I should have sat down and thought it through better," as that would have saved myself a load of time and some of my budget, but I didn't do that, so you get to read about me cocking up while sorting out one of my cock-ups.

The problem that I had left before Christmas (for those who missed last month's EIM) was to move the new sprocket I had carefully shrunk onto the output of the hydraulic motor, 10mm away from the other sprocket to allow the pins of the chain to pass each other without locking up. This was because when I shrunk the new sprockets on, I set them to the same distance apart as the old sprockets, not taking into account the width of the new standard chain I was using.

Hot under the collar

My first attempt to move the sprocket was to heat it up as much as I dared with it in position on the loco – it was close to the pump on one side and a brand-new support bearing on the other so I couldn't go too mad – and then whack it with a hammer. This had zero effect.

I then broke out the hydraulic separator which can put a ton of force between two close items. I had to wait for the whole mass of steel to cool, however, as the heat transfers from the sprocket to the carrier quite quickly so I only had a small window in which to get the sprocket hot enough to expand before the carrier did the same. Unfortunately the hydraulics had the same effect as the hammer, which is reassuring that I did a good job and the sprockets will not slip in normal operation, but not good news for me sorting out the interference issue.

This is where I should have sat and thought about what I was going to do next, rather than make assumptions. I decided that the next best thing would be to have one chain running from the hydraulic motor to the leading axle, then another chain between the axles. I would have to machine another sprocket, but decided that was quicker and easier than removing the motor again, disassembling the drive components and then putting it all back together. I ordered another sprocket and turned to other things.

I had noticed a pool of engine oil on the bedplate of the loco frames, so I took one side of the engine mounts off to have a look, although I already was remembering that we hadn't swapped the sumps over from the previous engine in our haste to get the new unit into the loco before Christmas, so I had a suspicion about what I would find. This was wholly justified when I discovered the side-mounted drain plug leaking straight onto the bed plate – the previous engine had a centrally mounted drain plug that sat over a hole in the bedplate allowing for access to change the oil.

I had already decided I wanted to put a remote valve onto the oil drain to make this job as easy as possible thanks to my broad shoulders and the 1ft gap in the pit not fitting together very well, so I had a dig in my box of fittings and came up with some bits that could work.

The first thing was to remove the drain plug and get the old oil out – this was achieved with as little mess as possible by butchering a water bottle ▶

PHOTO 1: The hydraulic spreaders used alongside heat application has not succeeded in moving the sprocket.

PHOTO 2: Engine oil leak showing on the loco frame.

PHOTO 3: Some creative butchery of a water bottle created a thing chute for the oil to the hole in the chassis.

PHOTO 4: Soft-soldered t-piece adapter with the ball bearing seal on one leg in place – the copper pipe leads through the hole to a valve.

Photos by the author

PHOTO 5: Lights fitted to the Simplex, much better for visibility.

PHOTO 6: The start of a long day returning the Ruislip Tamper, a blow-out nine miles into the journey.

PHOTO 7: Machining down the extra sprocket that was ordered.

PHOTO 8: Slitting saw used as before – with the thinner boss it reaches far enough to cut right through.

PHOTO 9: The extra sprocket set up on the clamp body.

PHOTO 10: With the clamps in place Harry could line up the sprockets and discover the chain would pass through the motor...

so the oil ran through this, down the hole in the baseplate and into a bucket in the pit. With that done, I drilled a hole down the centre of the plug on the lathe, cut, ground a filed the T part of the T to fit into the hole and within the engine mounts and once more didn't stop to think before rushing ahead.

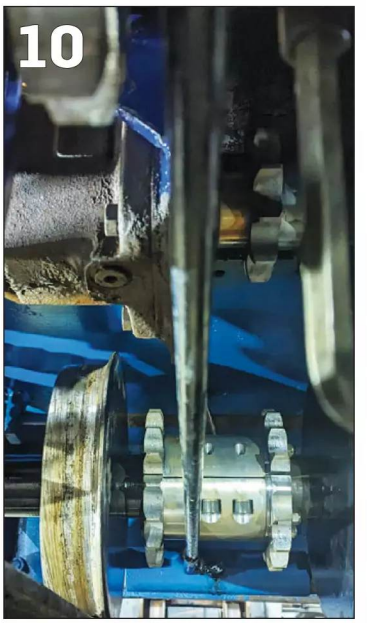
Soft option

I decided that I was going to soft solder this together as I had run out of silver solder and trying to braze brass fittings to steel is difficult to say the least – as future me discovered, this was a poor decision. Having soft soldered it and fitted it all back together with a length of copper pipe and a valve through the hole in the baseplate, I refitted the engine mount and turned to yet another little job.

The lights for our Simplex loco had finally arrived, so with a bit of careful work and a couple of new brackets, front and rear lights have been fitted to the loco – this has made a huge difference in murky conditions that occasionally infest Fairbourne in the depths of winter and has also allowed the track gang to work later and return in the dark.

With this done it was time to return the tamper we had been borrowing from the Ruislip Lido Railway in north London. Both the track gang and myself are incredibly grateful to the RLR for this loan, it has transformed the way track work has been done and made a huge improvement to our permanent way. I am also personally very grateful for the way the RLR handled the damage caused to the tamper and the extremely professional way they dealt with it all.

Unfortunately I had yet another



overly exciting journey, before I had got to Dolgellau, a mere nine miles from Fairbourne, one of the trailer tyres blew out on a pothole, necessitating a change at the side of the road. Unfortunately this same pothole had also caused a slow puncture on the tyre in front, so with frequent stops to re-inflate it, I managed to nurse it to a tyre shop in Shrewsbury which very quickly had me back on the road again.

After a quick stop at Ruislip to deliver the tamper I headed up to Yorkshire to Blackgates Engineering from whom I had bought two sets of heavy-duty metal drawers and two cabinets to continue my efforts to upgrade the Fairbourne Workshops. Following a very welcome cup of tea and a tour around the works, which was very impressive I headed home after a very long day.

Once back in Fairbourne and having put the cabinets and drawers into their new homes, I was presented with a parcel with the sprocket for Gwril in it, so proceeded straight into machining that. I did this in the same way as the others that I described in last month's article, apart from parting off most of the boss on the side of the sprocket. This also meant I could cut all the way through with my slitting saw which was definitely a bonus!

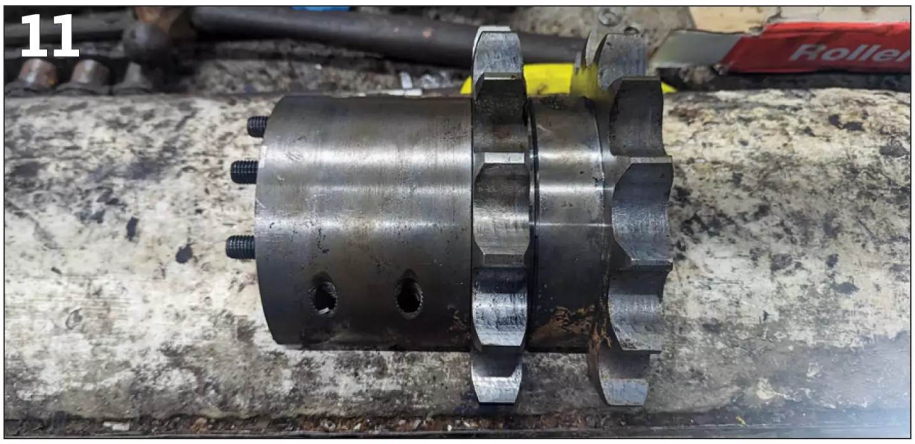
Wrong direction

I then assembled the sprocket onto the clamp as you can see in Photo 9 and wrestled it into place on the leading axle. It was only as I had removed, turned around and wrestled back on the rear axle sprocket that I noticed the chain I would be fitting between the axles would run straight through the middle of the hydraulic motor... Once again I didn't stop and think, so spent some more time and energy re-configuring the sprockets in a desperate attempt to find a path that was clear, utterly unsuccessfully.

In the end I was forced to admit that I needed to remove the hydraulic motor again. So the engine mounts were loosened, the rear of the engine and the pump lifted, the frame brace that holds the motor and sprockets was unbolted and I began wrestling the motor out with the occasional help from the overhead crane.

I quickly came to the conclusion that I would have to move the engine a significant amount more, so the engine mounts were completely unbolted from the baseplate and it was shuffled as far forward as I could get it on the hydraulic hoses before the motor and housing was released from the chassis. This came with a heavy sense of deja vu, which as you may have gathered, is a theme this month.

I then grabbed the pullers I had



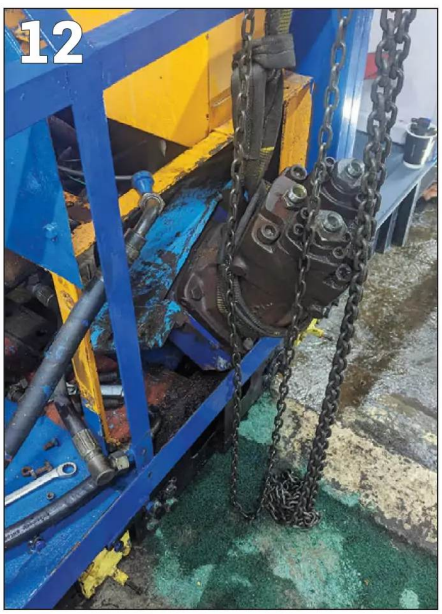


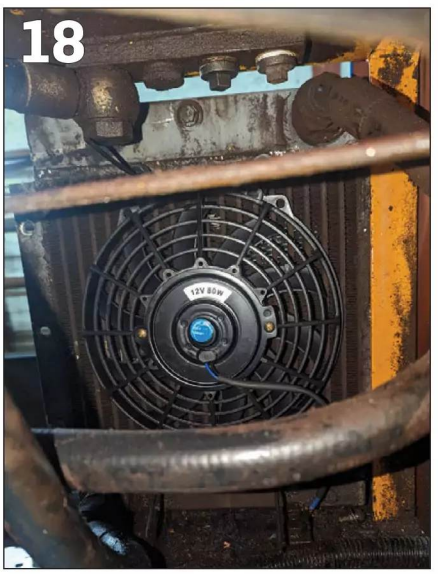
PHOTO 11: Reconfiguring the sprockets to try and get the chain into a space to clear everything.

PHOTO 12: The hydraulic motor had to come out again, Harry removing it with the frame stretcher.

PHOTO 13: Modifying the custom clamps Harry made for the first time he removed the sprocket carrier.

PHOTO 14: Harry experiences some deja vu...

PHOTO 15: Heat and the press was enough to move the sprocket enough to clear the chain rivets.



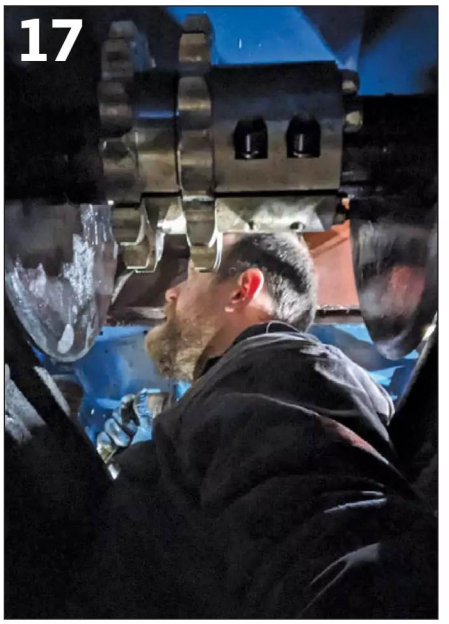


PHOTO 16: You can see the extra space between the sprockets now the carrier is back on the hydraulic motor.

PHOTO 17: With the frame stretcher out of the way Harry took the opportunity to occupy the space to remove the old hydraulic cooler fan. This shows the tight confines that our correspondent occasionally has to work in...

PHOTO 18: The new electric fan attached to the hydraulic oil cooler.

PHOTO 19: The old hydraulically driven fan with all of its associated pipework – there is a lot more room in the engine bay now.

PHOTO 20: Welding in the rose joint to provide some articulation for the hydraulic pump drive control linkage.

PHOTO 21: The hydraulic controls all the way one way.

PHOTO 22: The controls all the way the other way showing the necessity for the articulation, this has made the action of the control far smoother.

made the last time and immediately had to cut them up to fit – last time there was only one set of teeth on the sprockets, this time they had to fit between the sprockets. Apart from this little hiccup, the removal of the sprocket carrier went pretty quickly thanks to me having done it not too long ago. I set the sprocket carrier up in the press and then with a reasonable amount of heat and a lot of pressure the sprocket finally moved enough to work.

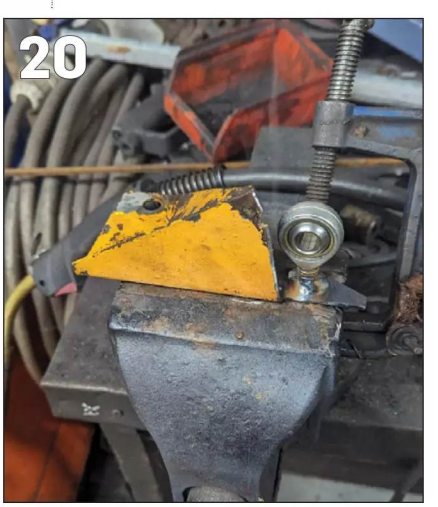
I could then refit the motor assembly with the sprockets and the frame brace all back together. Before I put it into the chassis though, I finally decided to use my brain and the space that the motor and frame brace had occupied to get access to the hydraulic oil cooler.

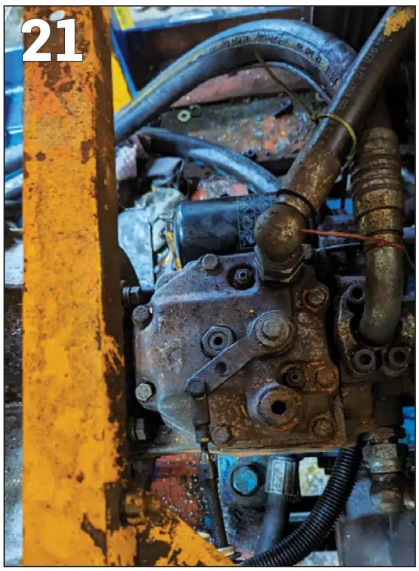
Electric air

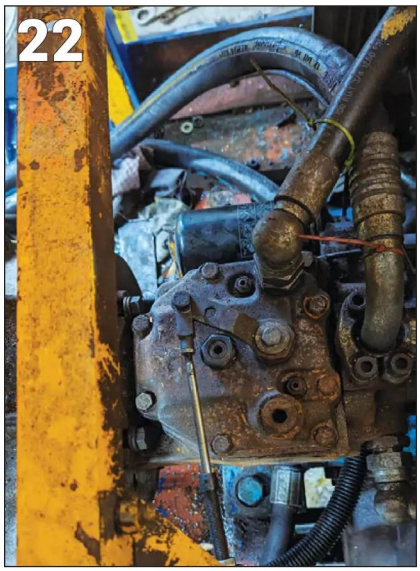
I had decided to replace the hydraulic oil cooler fan with an electric one to both simplify the hydraulic setup and reduce the amount of oil leaking out of all the joints – the original system had a completely separate hydraulic loop, only sharing the reservoir with the main drive system. It had a hydraulic pump driven from the back of the injection pump on the engine and a pressure regulator before the hydraulic motor driving the fan on the cooler.

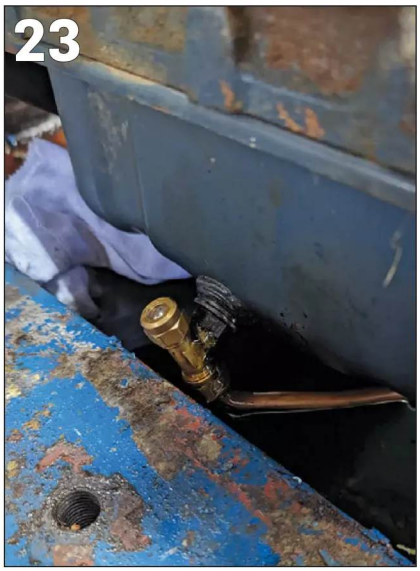
Removing the fan from the cooler involved six bolts, three down either side of the radiator surround. One side was easily accessible, the other however had seen parts of the body framing welded around it at some point in the past so required the cooler to be moved 10mm on its hoses. The bracketry for this move was definitely best accessed from the underside through the hole left by the motor.

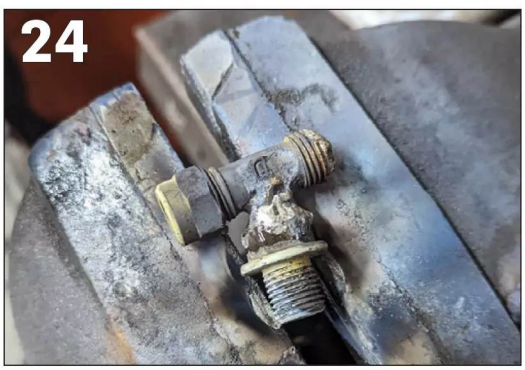
Once this had been done the whole fan drive assembly could be removed and then the new electric fan installed on the cooler. This will both provide more airflow and a constant flow, rather than the airflow











changing with the revs of the engine.

With the motor re-installed accompanied by much cursing and more wrestling I turned my attention to the hydraulic controls. These had been an issue because the end of the bowden cable used to operate the valve had to be left a little slack to allow the end of the push-pull cable to pivot as the valve turned. This would occasionally vibrate very loose until the midpoint (loco stopped) was very hard to find.

My solution to this was to use a rose joint, sometimes known as a Heim joint, welded to the bracket to allow the push-pull cable to pivot around the joint without being able to slip or move.

After sorting the hydraulic controls I started to put together a temporary electrical setup to test the engine, at which point I had another deja vu moment, a pool of fresh engine oil on the baseplate under the engine. So it was off with the engine mount and out with the leaking T-piece I had soft soldered. I suspect it had been knocked when I was moving the engine around to get the motor out and the soldered joint had failed.

I then cleaned it up carefully and brazed it all back together – this requires some very careful heat

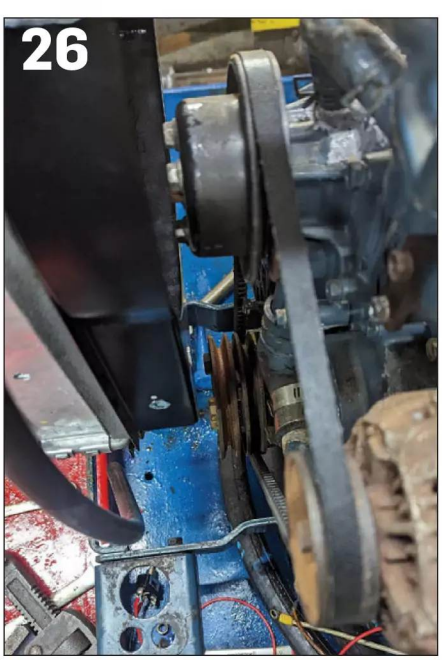
PHOTO 23: The soft-soldered joint has already failed.

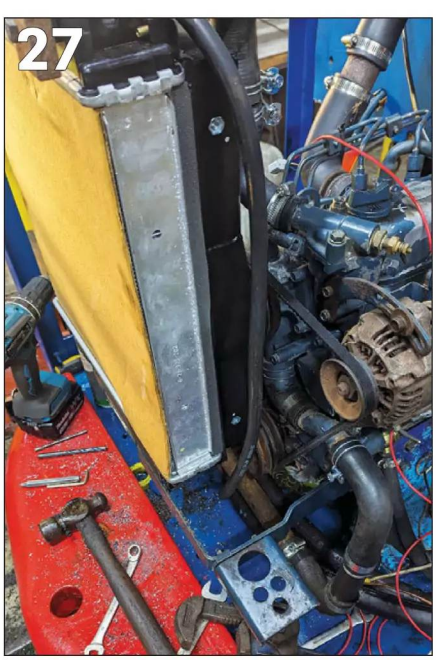
PHOTO 24: Harry did what he should have done to start with, brazing everything up instead of soldering.

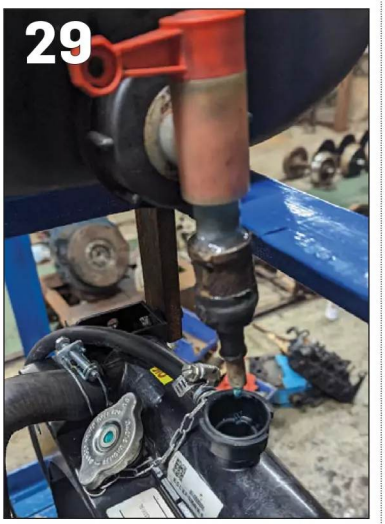
PHOTO 25: Radiator support bracket made up – large blocks on side hold rubber anti vibration mounts.

PHOTO 26: Everything set up to allow for easy belt changes in the future.

PHOTO 27: Some interesting hose routing for the coolant.







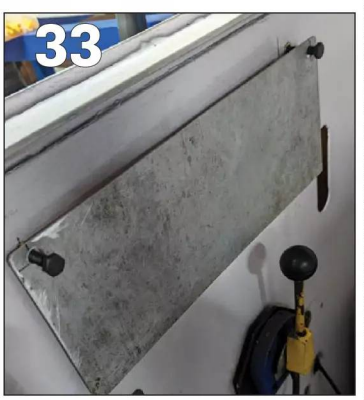
control so as not to melt the fitting but got it hot enough for the brass I added to flow correctly onto the steel.

I also took the opportunity to seal up one of the legs of the T with brass rather than using the ball bearing to seal it as I had before – the bearings are a fine temporary solution, but brazing it is far better.

I could then reassemble it all for what felt like the 10th time, which then allowed me to put the electrics together and run the engine in the chassis with the hydraulics all hooked up for the first time, which thankfully all went extremely well.

With the initial test run completed I then set about fitting the new radiator and shroud – a simple welded frame to match the rubber mounts already on the radiator and a couple of brackets at the top had it all in place. This was carefully done to leave enough space for belt changes and to have good access to the filler neck from the access hole already cut in the bonnet top.

The next problem to solve was the radiator hoses – the old radiator bottom outlet was on the opposite side so I had to pipe the new one across the front of the engine and into it from the correct side, thankfully with the hoses that came with the radiator and the old ones from the previous set up I could put together a decent finished product. I filled it with water first so that any leaks could be found and dealt with using cheap liquid rather than expensive coolant. Once the system was proved I then drained it and refilled it with decent coolant.



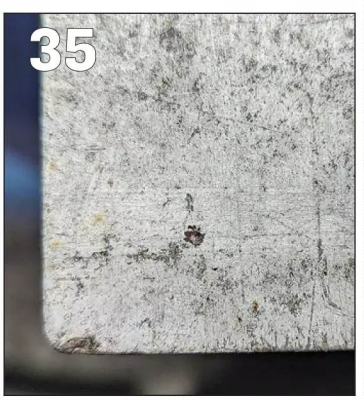


PHOTO 28: Filling coolant with water for first time so no coolant is wasted on any leaks.

PHOTO 29: After sorting the leaks Harry drained the water out and refilled with coolant.

PHOTO 30: Making a large round hole, Harry uses an angle grinder to make small slits to the line scored with odd-leg calipers.

PHOTO 31: This is followed with some quality time with a file.

PHOTO 32: After a bit of careful work the hole is the right size and shape.

PHOTO 33: After cutting a hole for the new electrical panel and fitting rivnuts Harry could make the actual panel.

PHOTO 34: A ball bearing in the rivnut will accurately transfer the hole position.

PHOTO 35: The mark left by the ball bearing.

Hole work

I then started on the electrical install which will be a complete re-wire, with a load of additions and changes to where everything apart from the battery was. The first job was to fit a battery isolator switch to the front of the battery box – there were already a load of holes there from the ignition switch, horn button and warning lights so I chose the biggest, marked it out using odd-leg calipers to the size I needed and set to work. I first used a slitting disk to cut a lot of material away to the line, before spending some quality time with a file to get it spot-on.

The next item on the list was to fit a proper electrical panel that could be removed easily for maintenance. I cut a generous hole in the bulkhead just above where the hydraulic tank is to allow all the electrical components enough space behind the panel, then drilled out the bolt holes and fitted rivnuts before cutting out the panel itself from a sheet of aluminium. I used ball bearings sitting in the rivnuts and a hammer to transfer the hole positions across, this is far faster than a lot of measuring and gives just as good results.

With that we will have to leave Gwirl until next month for the first test run and hopefully a return to traffic. If I had actually used my brain and looked at the various problems facing me properly, I could probably have had it done by the time I came to write this article, but unfortunately I am only human! EIM

Dual-use self-contained lightweight riding car

Julian describes a usefully versatile item of rolling stock he built to suit whichever kind of track he might be running his locomotive on.

BY **JULIAN HARRISON** Part One of three

I have a riding car that I built, a few years ago, that can be used on a raised track by fitting two skirts with footrests onto the main chassis. The chassis has two four wheel bogies. To operate on ground level the skirts are removed and a box frame fitted to the top of said chassis with the footrests moved to its sides. This arrangement works adequately but requires several bolts and pins to be assembled to either configuration.

This riding car will happily fit two adults or an adult and two children but carrying all the bits for both configurations takes quite a lot of room in my car. The unit also demands a fair amount of space in my workshop for its storage as it comprises 12 somewhat cumbersome components. Mostly my riding car is only used by me so I decided to design and build a small one-person riding car that would be quick and easy to assemble to either configuration and easy to transport or store.

First a quick word here about gauges. I have built this riding car to accommodate 3½, 7¼-inch but mainly 5-inch gauge locomotives as most of my locomotives are of this gauge. I have no interest in smaller gauges such as 2½-inch so have not included these in my calculations – even with the relatively light weight of this riding car it may still strain some smaller locos but that would be your choice. This is a single seater so if I want to haul passengers I will hitch a passenger car behind it.

I generally work with metric measurements but in my description of this project I will use both imperial and metric as some of the materials I bought were supplied as imperial. The rail gauges are always imperial.

Boxing clever

My logical starting point was that I needed a box to sit on when on ground-level tracks. This box could be used to store and transport all seven major components. The chassis of the car should just fit into this box but be able to be attached to the bottom of the box when used on ground-level track. On raised track the chassis is used with a couple of stirrup-type foot rests. The same seat is used with both configurations and forms the lid of the box when in transit or storage.

The frame of the box is 20mm hot-rolled angle iron TIG (Tungsten Inert Gas)-welded together and pine strips of wood. The panels are some 3mm ply cut to fit inside the frames. It is easily purchased from any DIY store, however mine was saved when I broke down a couple of old wardrobes.

The base is 6-8mm plywood cut to fit. Again this is easy to buy but mine was rescued from a couple of machine packing cases. The lid is a piece of 8mm plywood cut to match the outer edges of the frame. Upholstery is provided by a foam seat that just enters the top of the steel frame for storage and is attached to the lid.

On the opposite face of the lid is another piece of 6mm ply again cut to fit inside the frame. This is used to locate the seat when on ground-level track or fitted upside down with the padded seat inside the box to become the lid. When on raised track the seat will fit directly onto the chassis.

All other parts including the chassis, tow hitches and buffers will be easily stowed inside the box. The addition of a handle each end and some catches will secure the lid and make the whole thing easily transportable. If you wish to add a vacuum pump and battery or a water tank to the car there should be enough space spare in the box. You may have to experiment with where things go to obtain the best fit.

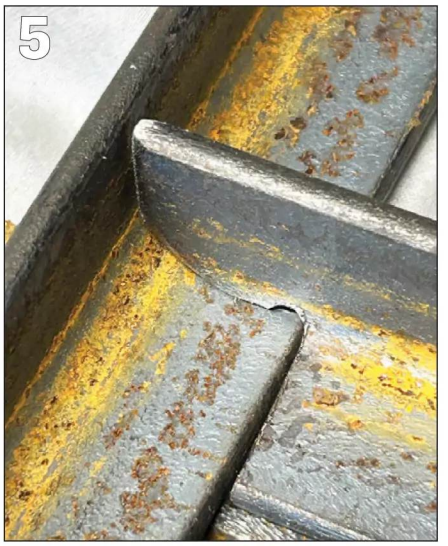
Metalwork

The chassis is TIG-welded together using 20mm square thin-wall mild steel tube. The buffer beams are some 3-inch wide ⅛-inch thick mild steel bar I had left over on my bench. The four wheels are turned on my lathe from some slices of 4¼-inch round steel bar. The axles are some ¾-inch inch EN8 steel bar turned to fit the wheels and the bearings, which are 12mm ID (internal diameter) units mounted in their own pillow blocks.

PHOTO 1: The riding car all packed up in itself.

PHOTO 2: Made up for use on ground-level lines...

PHOTO 3: ...and on raised-track.



These were easily obtained online for only a couple of pounds each. They sit on some springs set into the chassis and allow a small amount of movement to adjust to the unevenness of most tracks.

The buffers are turned from steel and have a bolt and washer to fit them to the buffer beams. They are easily removed to pack the chassis into its box. I fitted buffers because they look better and are needed if a chain is used to couple with – they are not so necessary with a solid bar.

"TIG looks so much better, is more controllable and has almost no mess..."

The front and rear hitches are similar to the buffers in that they are also removable. They have a slot in the end to attach the coupling bar and a threaded stub to screw them onto the centre of the buffer beams. They are long enough to give easy access to the end to fit the coupling bar – different ones could be made for different bars or chains or one could be made into a hook. Again they are easily removed to pack the chassis into the box. The box or the seat will be fitted to the chassis using four set holes with locating studs and four bolts.

All metalwork has been welding using my TIG-welder. I recently went on a welding course at the Machine Shop near Burbage in Leicestershire to learn TIG-welding – I can now weld steel and stainless steel whenever I need to. This course or a similar one near you is highly recommended as it has completely changed how I weld. I probably won't use my stick welder again in my workshop because TIG looks so much better, is more controllable and has almost no mess.

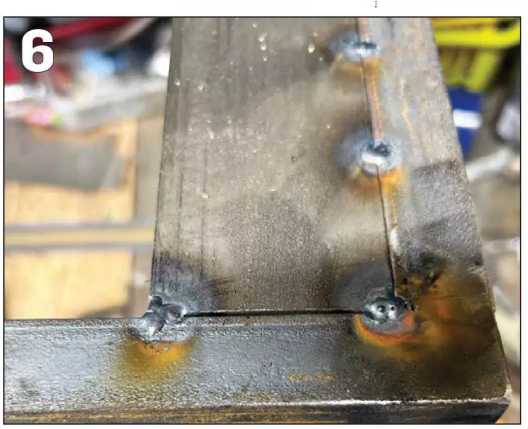


Photo 1 shows the riding truck all packed up and ready for transport or storage. In **Photo 2** it is set up for ground-level track and in **Photo 3** for raised track. Setting up for either use only takes a couple of minutes as does swapping from one to the other.

Dimensions

I will describe my build so it can easily be copied or adjusted to suit your needs. My original design included solid wheels and a steel frame for the box however the finished project was too heavy at just over 23 kilos. I reworked my build so as to reduce the weight to below 20 kilos to make it more manageable.

I will describe all relevant processes including those after I pulled the original riding car to pieces and rebuilt it to lose the required weight. So in some photos there will be paint on parts that would ordinarily have been painted later.

The riding car has been tested and works very well – the build is not rocket science so can easily be altered to suit the user or the materials available. Also if you cannot weld or have no access to a welder it can be bolted together but you will have to adjust many parts and add angle pieces which I have not described.

To decide the length of the riding car I simply sat down on a box. I measured from my back to my knee and came up with 600mm (24 inches) as a reasonable length. I started with a total width of 300mm (12 inches) and I chose 250mm for the height of the main box to give a better proportion to the truck. On ground-level track this will give a total height of around 375mm which means I don't have to bend my knees too much.

The wheels are 100mm diameter which holds the chassis at about 125mm high – this height works well with the raised-track configuration. At my local track the clearance from the track head is a maximum of 11 inches which is the same, I believe, for most clubs but to allow for any deviations on the ground I worked to 10½ inches. With the stirrup-style foot rests correctly fitted there should be about 375mm to the seat which should also be comfortable enough.

The wheels are fitted close to the buffer beams to give a maximum wheelbase and as much stability as possible. Wheels made smaller will obviously lower the riding car. I opted for larger wheels to iron out some of the bumps especially on ground-level track which more often than not has both five and 7¼-inch gauges. I find the gaps within points to be particularly bumpy for 5-inch gauge wheels. I have machined the width of

the wheels to midway between the standard for both these gauges for the same reasons but kept the width of the flanges near to the 5-inch standard.

The main box

I decided to fabricate the main box before the chassis because this controlled the size of most of the other parts, especially the chassis.

The frame of the box was originally made from 20mm hot-rolled angle iron. This is cheaper than the cold-rolled bright mild steel angle and was sufficient for what I needed. At my later strip-down and weight changes this steel was used only for the base with the rest of the box rebuilt using light timber.

The 600mm long side rails and 300mm end rails are all cut square to length. To help with the frame assembly the four end rails were put in the mill and a step milled in the ends to fit the profile of the side rails. As can be seen in **Photo 4** they were machined one end at a time, to be a loose fit to allow some movement for squaring the frames.

Photo 5 shows how the machined ends fit the side rails. They were spot-welded to hold them while they were checked and then the corners were fully welded. Pieces of 50mm by 3mm flat steel bar were cut and spot-welded inside the bottom of the frame to reinforce the bottom when it sits on the chassis. One can be seen in **Photo 6** once it was welded on. These were added as support for the chassis fixings and they were fitted within the frame so the base remains flat. Because the chassis fits inside the main box for storage (it has to be small enough to fit inside) it means the box overhangs the chassis both on the sides and on the ends. These two plates were fitted rather than relying on the wood floor for support and then to tidy the frame up and stop any corrosion it was sprayed with primer with gloss paint to follow later.

Some 3mm plywood was cut to fit the two sides of the box. They fit the inside of the frame and will eventually be bolted in. The same ply was used to make the end panels which fit against the side panels. There was no need to mitre the corners.

Further woodwork followed, four lengths of 20mm by 16mm pine cut 20mm less than the height of the ply panels. These uprights were screwed one at a time to the inside corners of the ply panels using the metal base frame as a jig for size. They sat down on the frame leaving the 20mm gap at the top and had the 20mm face against the side panels. I only used one screw either side of each corner just above the steel frame. At this stage I did not fit any screws in the top.

PHOTO 4: Milling the frame ends to fittings

PHOTO 5: They will fit like this when milled.

PHOTO 6: Frame and support plate welded together

PHOTO 7: Top of the box in the frame base.

PHOTO 8: corners joined with screws.

PHOTO 9: Inside view of box and batons.

PHOTO 10: A finished corner.

PHOTO 11: Finished sides.

PHOTO 12: end view of finished box

Photos by the author

Once all four bottom corners were screwed up I lifted the whole assembly off, turned it over and put the top edges in the frames. Now screwing just above the frames made the box the same size top and bottom as can be seen in **Photo 7**. Once all four corners were done it was all flipped back over and bolted into the frames. More screws were put in halfway up to complete the corners – I used countersunk screws so the heads were flush with the surface (**Photo 8**).

Next I cut lengths of the same timber to run around the inside of the top of the panels sitting on top of the corner batons just fitted, doing the ends first and the sides second. This gave these pieces something to sit on for extra support.

The base was cut from some 6mm ply I had in my workshop. This was cut so it just slid into the side and end panels. Obviously I had to cut the corners out to fit around the corner batons and the base was bolted in through the frame.

Once the base was in I fitted an extra upright baton in the centre of the side panels under the side top rail and sitting on the base. For added security all the batons had wood glue applied to them when screwed in. They can all be seen in **Photo 9**.

At various points I added primer and grey gloss to the panels though much of this was done before my redesign to reduce weight. I tend to paint at the end of a session in the workshop so it is dry the next day.

On the outside of the corners and top rails I glued and pinned some corner-profile timber. This is a timber moulding equivalent to the angle iron used for the base frame. It is slightly thicker but not enough to matter. With double 45-degree mitres at the top the four corner pieces were cut and fitted using glue and staple gun nails (**Photo 10**).

The next to be fitted were the mouldings on the top side rails. They were cut and fettled to a good fit on both their corners then glued and nailed in place. Finally the end pieces were fitted in the same way.

Photos 11-12 show all the trims fitted and ready for painting. There will be a couple of additions later but for now the box was painted. All the timber frames and panels were brush painted with primer and then household gloss paint. I chose a grey colour so this riding car would look like a goods wagon. Brushing the paint on gives a slightly rough texture to the bodywork making it look used. Then the panels were masked with tape to allow the timber mouldings to be painted black.

I decided to fit a handle on each end to enable the riding car to be lifted easily. Any suitable handles can be used – I had a bag full of the type that cut into the surface so at the top centre of each end panel I cut a suitable hole to take the handles ▶

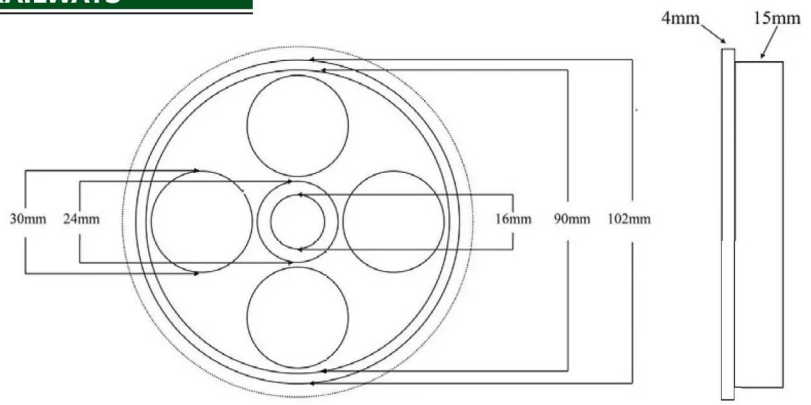
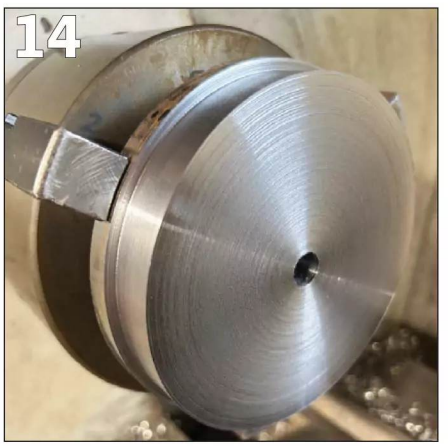
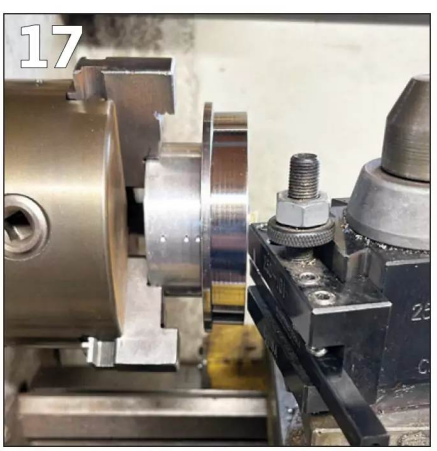


FIGURE 1
Riding truck wheel dimensions
Approx half full-size





(Photo 12). For now this is the box completed though there will be more work on it later.

Wheels and axles

I decided to fabricate the wheels and axles first as they would determine the width of the chassis and suspension mounts. For the wheels I bought four slices of EN8 round steel bar and my local supplier cut them for me to 25mm thick. The slices were 4¼-inch diameter which gave me enough to turn them to about 100mm.

First thing was to put each slice into the three-jaw chuck on my lathe and turn a couple of millimetres from the face to give a nice flat back as seen in Photo 13. Next they were each put back into the three jaw with the machined back against the jaws. I drilled the centre right through to twelve millimetres diameter and faced the front (Photo 14).

As shown in Photo 15 the tread was machined to a width of 16mmwide but the tread diameter was left 3mm oversize to allow for later finishing and profiling.

Each wheel was then turned around in the chuck and gripped by the tread face (Photo 16). The hole in the centre was bored out to a finished diameter of 16mm and the flange reduced down to 4mm (Photo 17).

Next I clamped a scrap piece of round aluminium in the three-jaw chuck to make a mandrel. Once this piece is set up in the chuck it **must not** be removed until **all** four wheels are completed. I turned the face off leaving a 17mm stub in the centre. This stub was then gently turned down to 16mm so the hole bored in the wheels just fits over it. The wheel sits on the mandrel (Photo 18).

The centre of the stub was drilled and tapped to M8 to accept an M8 bolt and a thick washer. One at a time each wheel was mounted on the mandrel and secured with the M8 bolt as seen in Photo 19.

The wheels now all needed to be turned to the same size – I used a small round cutter as this leaves a small radius at the root of the flange. I profiled my treads flat as most tracks I run on have square steel rails. If your track is aluminium and/or your club demands angled-profile wheels you will need to set your top slide to two degrees to obtain this profile.

Using calipers the wheels were all measured at the edge of the tread where it meets the front face to ensure all wheels were identical. The four wheels had the flange turned to give a nice rounded edge – Photo 20 shows all four profiled. I have found on most models and accessories, from past experience, that whatever is being built the wheels need to be correct and

uniform – they are, after all, the only contact with the track.

On a diet

Originally this was how I left the wheels but they were later machined further to reduce their weight. I performed this using my CNC mill – **Photo 21** shows the mill in action. The tool path was written to leave a 4mm collar around the axle and a 6mm tyre on the outside within the profiled tread. This was machined to a depth of 13mm.

Next the mill machined four 30mm round holes equally spaced around the centre. These holes were milled to a depth that broke through the back of the wheel. **Photo 22** shows all four wheels cleaned up and ready for mounting onto the axles. I realise that not everyone has access to a CNC mill but with some careful work the centre can be machined out with a lathe and then the wheels mounted on the lathe in a four-jaw independent chuck to drill the four holes. My wheels were 1.1kg each as blanks and reduced to around 450g once fully machined. **Figure 1** shows the dimensions of my wheels.

The axles are turned from some ¾-inch EN8 round bar. They were a simple turning job in the lathe as can be seen in **Figure 2**. Once cut to 220mm in length, both ends were faced to level them up.

The two ends just needed two shoulders turning onto them. The first one is turned for a length of 20mm down to 12mm diameter to fit the bearings as per **Photo 22**. The next shoulder is turned to 16mm for a distance of 28mm – this is for the wheels to be pressed against. These two shoulders, one each end, should be accurately set to 120mm to give the correct back-to-back measurement for the wheels on 5-inch gauge track.

Again they can be left like this but to further reduce weight I turned the whole of the centre of the axles down to 12mm, leaving a 6mm band of ¾-inch (19mm) to allow for the back-to-back shoulders.

The wheels can be glued or pressed on – which method is used is a choice of the builder. If they are glued on the axle can be machined a fraction smaller than the hole bored in the wheels. This allows the wheels to just be pushed on and leaves a small space for the glue. If they are being pressed on they need to be a tight fit. By accident both my axles had one end that was loose and one that was tight so my wheels were both glued and pressed on! This did not matter as there are no rotational drive pressures on them. **Photo 23** shows a completed axle with the wheels being pressed and glued. EIM

■ Julian will describe the chassis build of his riding truck next month.

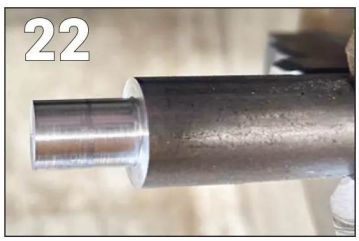


PHOTO 13: First facing of wheel back.

PHOTO 14: Machining front and tread.

PHOTO 15: Turning the back down to correct thickness.

PHOTO 16: Down to size and centre hole bored out.

PHOTO 17: Mounted on the mandrel for tread profiling.

PHOTO 18: Ready for profiling viewed from front.

PHOTO 19: Four wheels profiled

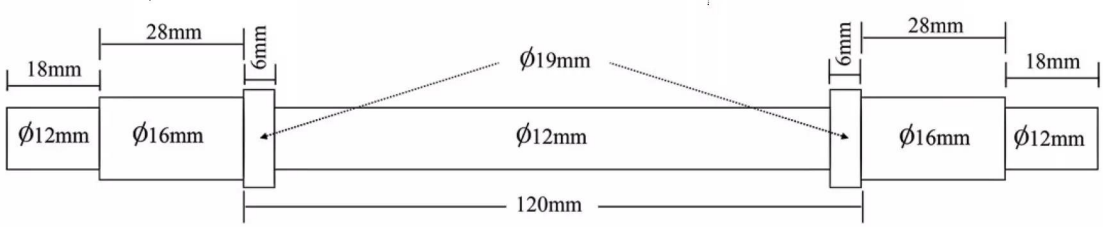
PHOTO 20: Weight reducing on CNC mill.

PHOTO 21: Four wheels after CNC 'diet'.

PHOTO 22: Turning the end of an axle.

PHOTO 23: Axle and two wheels being fixed together.

FIGURE 2
Axle dimensions
Approx three quarters full-size



Building a workshop

Rich tackles weather-proofing the roof and fitting the electrics in his workshop, en route to creating a comfortable working environment for model engineering.

BY **RICH WIGHTMAN** Part Three of four

I concluded last month's description with the roof of my workshop fitted and my waiting for the weekend to commence felting. Saturday came and thankfully was a dry and sunny day. The first job was to sweep the roof clear of leaves and such and then to roll out the base sheet of underfelt.

There are several grades of felt – the sort DIY places sell is okay for small sheds and rabbit hutches but really no good for a job of this size unless you want to redo it every year. I had the experience of using the thinner cheaper stuff on the old shed and it didn't last very long.

I used three rolls of base and three rolls of top felt. There was a fair bit of waste cut off each roll but I didn't want any joints. I rolled out the first base sheet at the back of the roof (the lowest point), leaving a good overhang at the back. When doing this you should think about the point where the second roll will overlap the first – when the top felt is rolled out try to get the overlap in a different place to that on the underfelt.

Excess all areas

The overhang at the back would be trimmed and drop into the guttering when it was fitted. Because I couldn't completely finish fitting the felt at this stage, not until all the walls were finished and the guttering fitted I also left a good overhang at each end –my concern at this time was to get the roof waterproof.

The base sheet is not glued down but left floating but to stop it slipping about I added a few staples. I used chalk to mark out on the roof to give me a guide when rolling out the sheets – I rolled out the second sheet overlapping the first and stapled it, then the third sheet was rolled out overlapping the second and overhanging the front of the roof.

"I had the experience of using the thinner cheaper stuff on the old shed and it didn't last very long..."

The green mineral top sheet could then be rolled out, again starting at the back of the roof, in other words the lowest point. It's fairly heavy this stuff so it won't slip about on the base sheet – again try to lay it in a place where the overlap is not directly on top of the base sheet overlap and make sure that the joining strip is in the right place, at the highest point. Again I left plenty of overhang all round.

At this point I realised that had I fitted the guttering first I could have fitted the roof felt straight into it thus avoiding the task of cutting it later, but the priority was to seal the roof.

The bare joining strip on the first roll now had to have a liberal pasting of felt roof adhesive before the second roll could be laid. This is horrible stuff, like liquid tar so it's best to wear disposable gloves. I applied it with an old 2-inch brush that could be thrown away at the end of the job. The second roll could now be rolled out along the line of the adhesive (**Photo 23**) and then nailed along the joint using galvanised roofing clouts (short nails with big heads).

The third and final roll is laid the same way and at this point I didn't bother to trim it to size but left a large

overhang at the front. I tacked all the overhang down just in case the wind got under it and tried to lift it off. It was then just a case of walking along, checking that the seams were stuck together okay and nailing down where it was necessary.

For the time being I could leave the roof until everything else was done. The next day saw heavy rain, a good test for my roof and I'm very happy to say that all was well – apart from what blew in through the open walls it was dry as a bone.

I now rigged up some temporary lights running off the extension lead so that when I got home from work at night I could carry on working, the first step being to panel the far end wall with plastic (**Photo 24**). With two walls panelled it was quite comfortable to work inside in all weathers.

Four lengths of floor board were now screwed up onto the internal beams to form an overhead shelf, 18 inches deep and at the same time tying all the beams together. The area at the door end does not have any of these extra beams as there is not sufficient height to clear the door. With the roof 99 per cent complete I now moved back onto the front.

The front revisited

Happy that the structure was now relatively weatherproof I could continue building the front wall. Ten diagonals were screwed in place, two under each window. I cut 10 lengths of 3-inch x 2-inch slightly over length and marked each piece by holding it in its position – I aimed to get a good tight fit on each piece.

I next cut five pieces of 3 x 2 to fit into the top of each window to complete the window frame. I marked and cut each piece in turn to get a good fit and screwed them in place up into the 8-inch x 2-inch plank (**Photo 25**). You can see in the picture that I was working at night now.

Now the front could have its plastic cladding fitted. I fitted the first length at the bottom so that it just covered the exposed floor beams and nailed it in place with the stainless-steel pins. I carried on up the wall until the bottoms of the windows were covered.

With the help of a few clamps and scrap wood it's a fairly easy job to trim away the plastic around the windows. It cuts easily enough with a rip saw and can be trimmed with a Stanley knife. An electric jigsaw will also make short work of it but it must be fitted with a very fine blade – coarse blades will shatter the plastic. I found it much easier to trim the plastic once it had been nailed in place and then used some H-section joining strip to complete the cladding on the front wall (**Photo 26**).

The next job was to completely cover the window frames in plastic. As stated earlier I wanted this new workshop to be as maintenance-free as possible, so no painting. I used plastic window board for this – the smallest size available is 150mm (6 inches) so it had to be cut down.

First I cut 20 lengths of window board slightly over size – five tops, two bottoms and 10 sides. To trim them down to the required width I used my band saw (**Photo 27**).

The four vertical 3 x 2 timber window frame sides are not wide enough for two pieces of the window board, (the window board lips touch) so they had to be packed out a bit. As it happened the waste from trimming the window boards was exactly the ▶

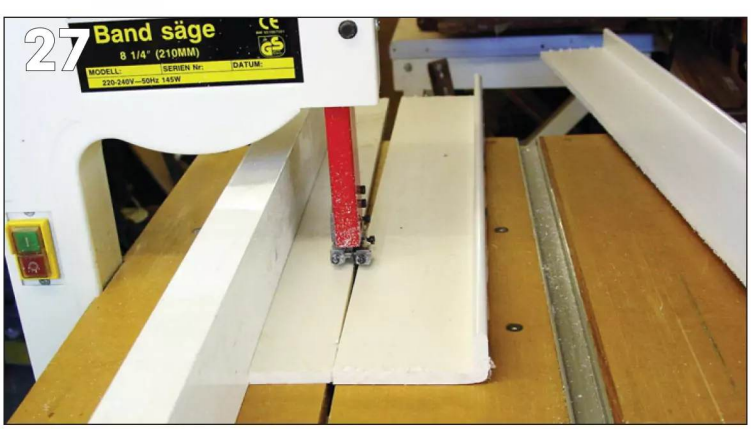


PHOTO 23: Laying the roof felt – rolls laid to avoid joins meeting.

PHOTO 24: The far wall has been clad with its plastic.

PHOTO 25: The braces and window frames are fitted.

PHOTO 26: Cladding the front wall.

PHOTO 27: Trimming the plastic window board to size

Photos by the author

right width so sections were nailed in place (**Photo 28**).

Each piece of window board must have a 45-degree mitre on each end. For this I used my mitre saw (**Photo 29**). Each piece must have its length marked from the job; no two pieces are exactly the same.

I cut the bottom piece first and fixed it in place with plenty of silicon, making sure there was a good bead of silicon along the lip to form a weatherproof seal – a couple of nails held it in place. A tip is to nail where the glass will eventually go so that they won't be seen.

I mitred and fitted the two sides, making sure there was a bead of silicon in the mitred joint, and lastly the top piece (**Photo 30**). I wiped away any excess silicon – a thought here, there are many types of silicon on the market that I'm sure would be okay but I bought all of mine from the supplier of my plastic, safe in the knowledge that it was the right stuff.

Well, that was one window down, there were four to go, all done the same as the first. And with all the window frames lined with the plastic window board they now needed beading. Some 40 lengths of beading were required, five tops, five bottoms and 10 sides for the inside, plus the same again for the outside.

Once again each piece of beading had to be mitred at each end, another job for the mitre saw. Each piece must have its length taken from the job and once all the pieces were cut I marked the position of each with a marker pen on an unseen face and then they could be fixed in place with silicon.

The first set of 20 must be fitted to the inside of the window frame. When they had set in place (I allowed 24 hours for the silicon to set) I carefully measured each window frame. I measured in three places along the top and sides and used the smallest of the three measurements. To be on the safe side I then deducted 3mm from each measurement to ensure that the glass would be an easy fit into the window frame.

"I decided not to have any opening windows as a security measure but having been in my new workshop on a hot day some form of opening window would have been an advantage..."

PHOTO 28: Plastic offcuts were used to pack out the window frames.

PHOTO 29: A mitre saw employed to cut the ends on the window board.

PHOTO 30: All the window frames fitted.

PHOTO 31: Fitting the first window glass.

Visible progress

Armed with the measurements the glass could now be ordered. I used double-glazing sealed units for the five windows. There are other options of course, single glazing, Perspex or such like, or better still if you can pick up some units secondhand and make your frames to suit.

Anyway the glass was ordered and duly arrived. I used a good thick bead of silicon all round the window frame and beading already fitted and lifted the glass into place, gently pushing the glass into the soft silicon until I could see it squeezing out all round.

Now I applied another thick bead of silicon around the edge of the glass and window frame and fitted the outside set of beading, pushing it into the soft silicon until it squeezed out all round. **Photo 32** shows the first glass fitted with the bottom beading in place and **Photo 33** shows a side beading being fitted. Again any excess was wiped off.

The next four windows were glazed in the same fashion. I decided at the start not to have any opening windows as a security measure but having had the experience of working in my new workshop on a hot day some form of opening window would have been an advantage. But with a fan running it soon makes for a comfortable environment. It's a bit of a tedious and time-consuming job making windows this way but

hopefully they will last my lifetime and above all be maintenance-free.

With the windows completed I returned to finishing off all the cladding and once this was complete I fitted a length of plastic angle to each corner of the workshop with a good bead of silicon and held in place with stainless steel nails (Photo 33).

Back to the roof

The next Saturday afternoon was also dry and sunny so with the help of the good mate we were back on the roof. First job was to fit the guttering along the back. This is fairly straightforward; the guttering is all designed to simply clip together.

I tacked a nail in one end and then using a spirit level ran a string along the back to a nail in the other end, to give a slight fall towards the down pipe. I then used the string as a guide to screw in place all the guttering brackets – this was all done with me working from the roof and leaning over the back.

With the brackets in place the two lengths of guttering with their joining piece are simply clipped in. The far end, the highest point has an end cap fitted and the near end has a bucket and downpipe fitted.

The overhanging felt at the back was now trimmed to lie in the guttering while the overhanging felt at the front and both ends was trimmed and nailed in place. To trim up the edges of the felt 150mm wide flat plastic was fitted to the front and ends with the stainless-steel nails. This gives a very neat finish.

Open goal

Last but not least to finish the exterior was the door. I had planned to make a solid timber frame and face it with the plastic cladding (maintenance-free). I was still debating which way the door should open, looking from the outside it would hinge on the right and open outwards or hinge on the left opening inwards onto the near end wall. Opening outwards was probably favourite as none of the space inside the workshop would be lost.

I had just about decided on the method of construction when a bit of luck came way. A mate offered me, free of charge, a brand new white plastic front door complete in its frame. The small window along with its beading was missing but it did come complete with handles, lock and even a letter box!

The one down-side to this was that the door hinged on the right and opened inwards which unfortunately was neither of the two options I had planned on. Having weighed up all the options I decided the offer of a ready-made door was too much to turn down. As it came as a complete unit its frame could be taken out and replaced at a future date.

"The one down-side to this was that the door hinged on the right and opened inwards which was neither of the two options I had planned on..."

So with the new door back home it was measured up and the aperture in the front of the workshop made to size with 3 x 2 timber and plastic cladding to finish. The door and its frame was lifted into place and secured with screws and sealed in with silicon. I had a piece of clear Perspex big enough for the window. This was simply stuck in with silicon and trimmed round the inside with plastic.

Having used the door for some time now it hasn't caused me any problems and I'm quite happy with the way it opens. It's worth a mention here I think that when my house insurance came up for renewal I decided that I ▶

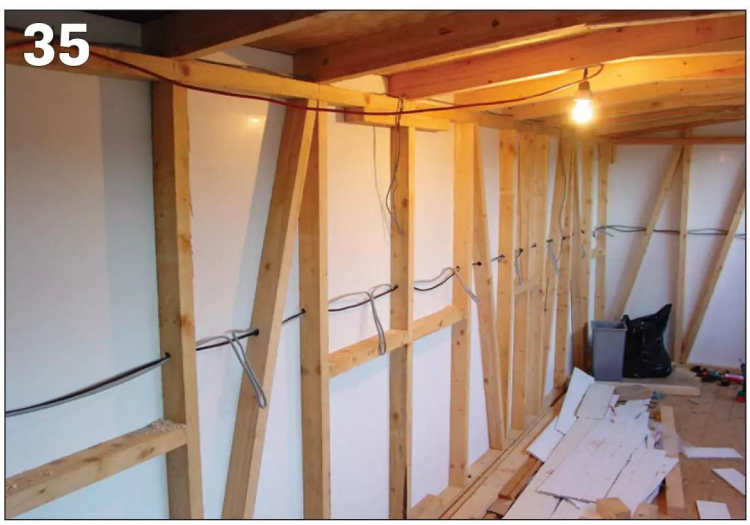


PHOTO 32: Side beading added to edge of each window.

PHOTO 33: Corner beading next to be fitted.

PHOTO 34: The impressive-looking door– an opportune purchase that insurers liked.

PHOTO 35: Laying in the cable for the ring main.

PHOTO 36: Insulation ready for installation – vital for model engineering in comfort...

"If I need to nip in the workshop to get something I can just switch on one light – better than having all six come on together..."

would have the new workshop included. The insurers were very happy with the fact that it had a proper door with its security locks and that the windows were double glazed units and non-opening (Photo 34).

The electrics

As I mentioned earlier it's well worthwhile consulting a qualified electrician but even so the bulk of the work, laying in cables, cutting in the socket back boxes and such, you can do yourself.

I had decided early on in the planning stage that I was not going to skimp on power points. How many times have you had to unplug one thing to plug in another? How many double adapters and trailing extensions have you got? Double sockets and back boxes are relatively cheap so I decided to put in 16 double sockets – this may sound a bit over the top but I tell you it's fantastic. No matter where you stand in my workshop there is a double socket within three feet.

With the power cable already laid into the workshop it was simply a case of running a ring main around the interior. I started by marking a line all round the workshop on the vertical beams and marked out where I wanted my sockets. When you do this you need to think about where benches are going and what height they will be. Do you need any sockets below bench height?

Once satisfied with where I wanted everything I drilled 22mm holes through all the beams. The trick is to drill the holes at least 35mm back from the front edge so that when the ply panels are fitted using 25mm screws there is no danger of accidentally hitting a cable.

With all the holes drilled the cable could be pulled through (Photo 35). I held the drum of cable on a short length of broom handle laid across two Workmate-type benches so that the cable unwound without twisting and knotting.

Tug of war

Pulling the cable through is a lot harder than it sounds. It's okay going down the first straight run of 24 feet but then it's got to go round a corner and on for 7 feet 6 inches then round another corner and down 24 feet and round another corner to get back to the start point.

As if that's not enough you now have to pull through enough to make a loop at each socket point. I made an extra loop at the far end of the workshop which would eventually go out to the garden shed (my old 8 x 5 workshop) which was already wired up for power and lighting so might as well be wired up again. Another loop was pulled through below bench height where my lathe would go to wire it directly into the ring main.

I'd decided on six 4ft fluorescent lights, three along the back and three along the front. A double light-switch just inside the door would switch on the first light at the back and the first light at the front with the other four lights being individually switched on their own pull cords. That way if I need to nip in the workshop to get something I can just switch on one light – better than having all six come on together.

With the lighting decided upon I could now lay in all the cables leaving loops at all the required points. While it was accessible I also pulled through a satellite cable and a TV aerial.

With all the cables laid in I took plenty of photos covering the whole workshop for future reference – you never know when you might want to stick up a shelf or break into the ring main to add extra sockets, unlikely in my case but better to have knowledge of where things are than not.

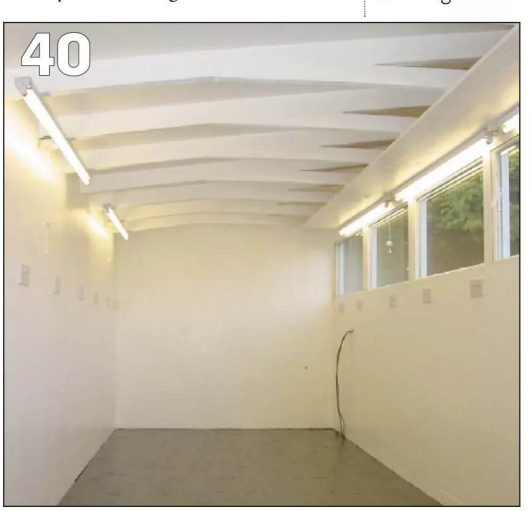
If you are using an electrician have

PHOTO 37: Packing the walls with insulation/

PHOTO 38: A socket back box – always better to have too many than too few.

PHOTO 39: All the panels on and the sockets fitted.

PHOTO 40: All painted out and ready for filling!



him check the work so far before you start fitting the panelling. The panelling I used is 6mm ply. Before each panel was screwed on I filled the space in the walls with glassfibre-type insulation (**Photo 36**). Because of the odd-shaped cavities in the wall I found it easier to split the bags of insulation open and then cut it to shape – easy with a Stanley knife. A staple gun helps to tack the stuff in place, then staple the plastic lining back on (**Photo 37**).

I trimmed the first sheet of ply to size and marked out for the socket boxes. I used the sort of boxes designed for use in plasterboard walls – they simply push into the holes and fix in with their own built-in clips (**Photo 38**). It's important to cut the holes exactly the right size as there is not a lot of room for error.

With the holes cut I lifted the panel into place, pulling the cable loop through the hole, and screwed it to the wall beams. The rest of the panels went on in the same way (**Photo 39**).

Once all the panels were on the double sockets could be wired up and screwed into their boxes. The six fluorescent lights could then be fixed up with their individual switches and wired up. It just remained to connect to the mains and test.

Escape blocked

With all the panels fitted it was time to get the paint out, but before that I went round the whole workshop top to bottom with a silicon gun, filling in every gap in the place – I'm a firm believer that there is a god of inanimate objects, some force that compels things to go where no human can. While wiring up the sockets I dropped one of the small brass contact screws and watched in disbelief as it bounced across the workshop floor and down a knot hole less than 10mm in diameter. The little devil went straight for it, the only hole in 180 square feet of floor. But I had the last laugh; I sealed the hole up with the screw imprisoned inside.

The entire workshop, apart from the floor, was given four coats of brilliant white vinyl silk emulsion. The floor was then given two coats of grey floor paint (**Photo 40**). In the photo you can see the overhead shelf screwed to the roof beams.

Well that was about it for the construction and if I may be permitted to say so a job very well done, I was chuffed with it. Next time I will conclude the description with the fitting out of my workshop. **EIM**

■ Parts one and two of this series appeared in the January and February editions of **EIM**, for how to obtain a back issue see page 8.

A tale of woe...

Brand new may not always mean highly accurate...

BY **ROGER VANE**

I thought that **EIM** readers might be interested in my recent experience with some new equipment, and the value of checking it out before first putting it to use.

I fancied owning a new rotary table which could be mounted either horizontally or vertically – it was a 'nice to have' really, as I already have a good horizontal rotary table and a universal dividing head. I'll mention at this point that the run-out of my existing rotary table central bore is less than a thou.

Anyway, I purchased a new HV rotary table, complete with a three-jaw chuck on a special backplate which located in the Morse taper in the centre of the chuck. I also purchased an ER32 collet chuck and a Myford nose adaptor, both with Morse tapers for location. All were purchased from a well-known supplier of imported machines and tooling.

As I always check new equipment before first use, I decided to analyse the runout of both the rotary table and the chuck, together with the Morse taper spindles purchased specifically for the table. Unfortunately, the accuracy of these items was far from satisfactory and as such, they were not fit for purpose.

Firstly, I tested the rotation of the table using a fully ground 2MT test bar in the taper, and found the TIR (total indicated runout) to be around 0.003-inch, which was not really acceptable. As a precaution, I checked the bar in the headstock of my Myford Super 7 lathe and I found the runout to be undetectable.

Then I mounted the chuck/backplate combination on the rotary table and again checked for runout. This was far worse.

At this point I decided to use the Myford (with its known undetectable runout) to check the chuck and backplate concentricity, as results using the rotary table would be unreliable due to its spindle runout.

Dial disappointment

The dial indicator initially showed the runout of a 7/16-inch dia dowel as around 0.062-inch TIR – yes, that's right – 1/16-inch. I also checked the runout of the register on the backplate and found that this ran out by 0.003 TIR – hardly precision machining.

The chuck register on the backplate was also a 'slack' fit, with a movement of at least 0.002-inch in the chuck, leading again to potential errors. However this slack, and the register error, by no means accounted for the chuck runout measured.

"The accuracy of these items was far from satisfactory and as such, they were not fit for purpose..."

I then decided to check the chuck itself for burrs on the ends of the jaws. I noticed that the gap between adjacent jaws was quite variable, and that effectively they were not meeting in the centre, hence the excessive runout. Removing the jaws, and then checking for and removing burrs reduced the runout to a mere 0.036-inch TIR. Fully closed, the gap between adjacent jaws was between around 0.002 and 0.015-inch, although exact measurements were not possible due to the gaps being tapered.

I also took the opportunity to check the ER32 collet chuck, and found that a 7/16-inch collet would not close onto the 7/16-inch diameter dowel, indicating that this item was also at fault, where the bore was effectively too deep or too large. Running a check on a smaller dowel and collet indicated a runout of approximately 0.005-inch TIR, totally unacceptable for a collet chuck.

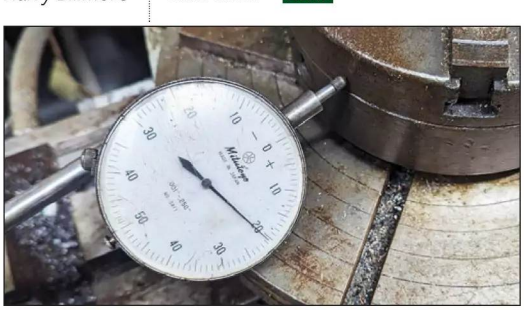
The Myford nose adaptor was slightly better, where the runout on the register was found to be only(?) a couple of thou.

Buyer beware

My experience brings into question the manufacturer's production techniques, together with the inadequate quality control procedures adopted by both the manufacturer and my supplier – certainly a case of 'buyer beware'. Such faults are sufficient to deter newcomers to the hobby for life.

As such, these items were unusable, and needless to say that they were returned to the supplier for a full refund – around £330.

The moral of the story? – always check any new equipment before it is first used. **EIM**



BELOW: No matter the age of your equipment, accuracy should never be assumed, but checked on a regular basis. *Photo: Harry Billmore*

A Retyrement Project

Peter and Matthew conclude their project to re-tyre a 7¼-inch narrow gauge locomotive that they purchased secondhand in 'well-used' condition.

BY **PETER** & **MATTHEW KENINGTON** Part Two of two

Last month we described the first part of our project to replace the very worn tyres on the 7¼-inch gauge 'Tom Rolt' we had purchased secondhand. Having measured all of the now machined wheels, with their original treads removed, we worked out the maximum diameter we had to work with, based upon the minimum residual wheel diameter.

We wanted to machine all of the wheels to the same design and then all of the tyres to match that design (with a suitable allowance for shrink-fitting, as will be discussed later). That way, we would not need to worry about stamping the wheels to ensure that the correct tyre was fitted to the correct wheel.

The dimensions we ended up with were provided earlier in Figure 1 and Figure 2. The next task was therefore to machine the 'steps' in the wheel (outer diameter) and the tyre (inner face). We chose to start with the wheels on the basis that if we made a small error, then we could adjust the dimensions of the tyre to suit. In the case of an extreme error, it is cheaper to remake the tyres than the wheels!

A wheelset was returned to the lathe, using the same 'between centres' arrangement as before and the steps were machined on each wheel (**Photo 33**). We elected to turn the wheelset around to machine the second wheel, so that the wheel being machined was closest to the headstock. This arrangement is slightly more rigid than machining closer to the tailstock/live-centre. The reproducibility of a 'between centres' arrangement makes this a sensible option; I'm not sure we would have tried this if we had been using a three-jaw chuck instead (not that we could have machined a wheel we were holding in the chuck, anyway!).

All being well, a completed wheelset should look something like **Photo 34**.

Annular Return

The next task is to do the same on the inner faces of the tyres (**Photo 35**). Again, we used our four-jaw chuck and neodymium magnets as discussed in part 1. In this case, the latter act as 'spacers' and (once removed) enable the boring bar to penetrate right through the inner of our annular ring without there being any danger of it hitting the chuck!

Note that we are not looking to precisely match the dimensions of the wheel in this operation – if we did this, the tyre would, at best, be a loose press-fit onto the wheel and at worst would slip on easily. In both cases (and even with the judicious use of Loctite), our new tyres would almost certainly slip on the wheels, when attempting to put down any power. We will discuss this aspect of the design next.

One final thing to point out is that the inner corners of the machined 'steps' will have a small radius, set by the radius of the tip of the lathe tool chosen. This radius is non-negligible and must be taken into account during the machining of the matching outer corner. In other words, the outer corners need to be radiused or chamfered so that they don't foul on their matching inner radii.

Chamfering is the easier option and there is no danger of doing 'too much', as this aspect won't be seen in the finished wheel/tyre combination, so be generous. If this isn't done

■ Part one of this feature appeared in last month's edition of EIM. To download digital back issues or order printed copies go to the website www.world-of-railways.co.uk/store/back-issues/engineering-in-miniature or call 01778 392484.

correctly, the tyre will sit a little proud of the plane of the wheel, which will annoy you every time you look at the loco (even if no-one else spots it)!

Going for Growth

This is a tricky one... There are a number of conflicting requirements and different assumptions which can be made, when designing the degree of 'overlap' (or 'interference') between a tyre and a wheel. I won't pretend that we are experts here; we picked some values based upon research and (hopefully) sensible criteria and the final result worked splendidly. On this basis we picked 'right', however whether our choices were 'optimum' is far more open to question.

Firstly, what are the competing issues? The main one is the degree of interference between the wheel and the tyre. In an ideal world (and especially with steel tyres, which are relatively 'elastic'), the degree of interference would be as large as possible, commensurate with being able to expand the tyre sufficiently to easily 'drop' onto the wheel, with there being no possibility of it getting stuck part-way – this scenario was my 'wake up in a cold sweat ultimate disaster' scenario!

A large degree of interference would mean that the tyre would grip the wheel extremely well and would never slip (relative to the wheel) no matter what forces were demanded of it. Steel, being relatively elastic, is unlikely to crack under any sensible interference value, so this would seem to be the ideal scenario.

Unfortunately, the wheels themselves are made of cast iron and this is not renowned for coping well with stresses – we had read about this issue elsewhere during our research. We were afraid that putting excess stress on the wheels, by the crushing force of the tyres as they contracted, could cause the spokes to crack and then we would need to buy/machine new wheels – this was my other 'wake up in a cold sweat ultimate disaster' scenario. We therefore had to pick a compromise value.

We decided to err on the side of caution regarding crushing our precious wheels, on the basis that if it all went horribly wrong (in other words there was insufficient interference between the wheel and tyre, resulting in the tyre slipping) then we could always machine off the tyre and try again. It would be expensive and time-consuming, but much less expensive than buying new wheel castings.

"We were afraid that putting excess stress on the wheels, by the crushing force of the tyres as they contracted, could cause the spokes to crack..."

We picked an interference of 0.1mm (in diameter); theoretically something a little less should have been fine (0.06 – 0.08mm, say), but we really didn't want to go through this process again – we were cautious, but not too cautious! For smaller/thinner wheels, it would probably be better to go for a smaller value, say 0.06mm – the same sort of number which would normally be used for a press-fit.

PHOTO 33: Machining the 'step' on the wheels

PHOTO 34: Wheelset with the completed steps visble.

PHOTO 35: Matthew machining the 'steps' on the inner faces of the tyres

TABLE 1: The thermal expansion of a steel ring.

Photos and diagrams by the authors

Through thick and thin

The other issue to grapple with was, does our tyre constitute a 'thick' annular ring or a 'thin one', from an expansion perspective? There are different formulae for calculating the expansion of a ring which is assumed to be 'thick' against one assumed to be 'thin' (the latter being aimed at pipes, primarily). We decided to explore both options and see how much of a difference there was and hence whether we would need to make a (difficult) choice or whether we could easily pick a compromise. Again, I didn't want to end up with a tyre stuck part-way on to its wheel!

For a thick ring:

$$L\text{-}L_0 = L_0\,\alpha\Delta T$$

Here L is the expanded diameter, L_0 is the starting diameter, α is the expansion coefficient of the material (mild steel in our case, at 10.6 x 10^(-6) mm/mm degrees C) and ΔT is the change in temperature.

With an internal diameter of 155mm and a 200 degrees C temperature rise (for mild steel), the diameter of the hole in the ring will expand by approximately 0.36mm. A 200 degrees C temperature rise was picked as an absolute minimum we were likely to heat to (allowing for a little cooling between the hearth and wheelset locations) and also one which could be achieved in a domestic oven (should the need arise – I know others have used such means).

For a thin ring, the calculator provided at: https://www.engineeringtoolbox.com/thin-circular-ring-radius-temperature-change-d_1612.html, gives the values shown in **Table 1**. The change in diameter is therefore approximately 0.33mm.

The thick and thin ring approximations are therefore close enough to each other that we needn't worry too much and are both expansion values which are sufficiently large that we shouldn't suffer from the tyre-stuck-half-way problem of our nightmares – assuming a reasonable surface finish in our machining operations.

If we now consider the other extreme – we heat the tyre far too much before dropping it over the wheel, where would that leave us? After all, heating a large annular ring in our crude hearth, with a 'roofers' (= big!) burner on our Sievert torch, is not an exact science. If we substitute a temperature rise of 500 degrees into the more pessimistic of the two formulae (more pessimistic from the perspective of over-expanding the tyre, that is), in other words the 'thick' ring formula, the resulting expansion is: 0.82mm.

So, if we make our locating 'step' on the wheel and the tyre a good deal greater than 1mm (in diameter, so a 0.5mm shelf-depth), then we should be confident that the tyre will not bypass the wheel and fall unceremoniously – and somewhat dangerously – onto the bench. This is another nightmare scenario I probably forgot to mention... We ended up using a value of 4mm for our 'step' (8mm difference in diameter). We could therefore sleep soundly, at least in regard to this latter nightmare scenario.

In our case, this was an easy problem to solve – our wheels are (relatively-speaking) huge and so we had plenty of metal available to make a large step (and perhaps didn't need ▶

Circular Ring - Temperature Expansion Calculator

Calculate the final diameter of a thin circular ring after temperature expansion. The calculator can be used for metric and imperial units as long as the use of units are consistent.

155	d_0 - initial diameter (m, mm, in)
200	dt - temperature difference (^oC, ^oF)
10.6e-6	α - temperature expansion coefficient (m/m^oC, mm/mm^oC, in/in^oF)

Calculate!

- Circumference change (m, mm, in): 1.03
- Final diameter d_1 (m, mm, in): 155.329

TABLE 1

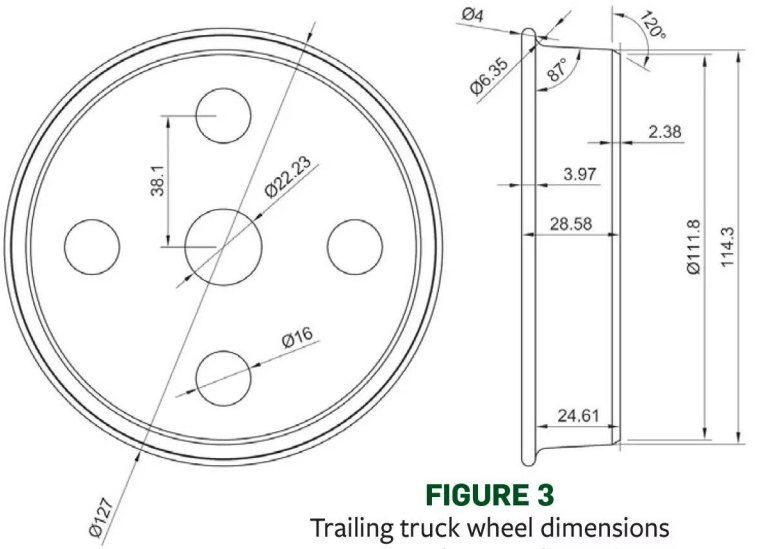


FIGURE 3
Trailing truck wheel dimensions
Not to scale – use dimensions

to go through the whole expansion-calculation process). We did, however, want to learn and be able to apply our new-found knowledge to smaller wheels, such as those on our 5-inch gauge Super Simplex, which will one day face the same challenges.

Only four?

Tom Rolt, as the better-informed (or more observant) of you will know, has a total of six wheels: four driven ones and a two-wheel trailing truck (just visible on the upper right-hand side of Photo 16). Fortunately, the truck wheels are: **a)** somewhat smaller than the driven wheels, and **b)** much easier to fabricate, essentially being discs with four additional holes drilled in them – presumably as a weight-saving measure on the full-size prototype (**Photo 36**).

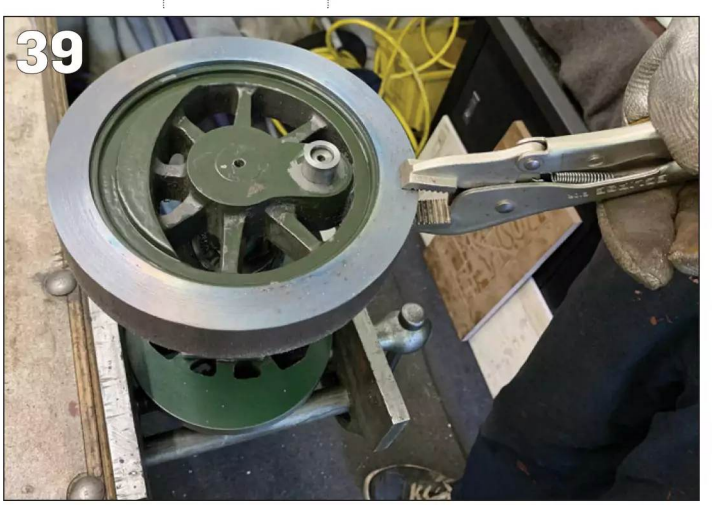
We managed to get the pony truck wheels off their axle without too much difficulty – they were a 'light press-fit' (as per the drawings) with, we think, a little Loctite added. Applying some heat and a little but not excessive force, facilitated their removal and the ability to re-use the original axle.

"We did want to learn and be able to apply our new-found knowledge to smaller wheels..."

The steel discs for each wheel were machined to a little over-size and the centre hole for the axle then drilled and reamed. The wheels were transferred to the mill, where the four weight-saving holes were drilled using a blacksmith's drill bit.

The resulting part-made wheels were press-fitted onto the original axle (**Photo 37**) and returned to the lathe, where the final wheel profile was added. Machining the wheels this way ensured than any small eccentricity or wobble that was introduced into either wheel by the press-fitting process, could be eliminated in this final machining operation.

Note that machining the wheelset as a complete assembly does mean that the axleboxes spin along with the wheels, when on the lathe. There is obviously no danger of these coming off during machining, so this is not a particular problem. The axles already had centre 'pops' in both ends, which made setting up with a tailstock live centre very straightforward. They could again be machined 'between centres', for extra precision, as with the driven wheels.



Quick-fit

The process of heating and shrink-fitting the tyres was much easier and went much more smoothly than we had expected. There was an element of 'fear of the unknown' about the whole process and plenty of nightmare scenarios (discussed above) which could have befallen us, but none did. If you're reading this with similar reservations and fears to those we had, then I would encourage you to 'feel the fear and do it anyway', as the modern mantra in career management goes.

We set up a rudimentary outdoor hearth using some ceramic fire bricks. These are the sort of thing usually used to surround fireplaces; they are both lightweight and cheap and, unlike 'proper' fire bricks (in other words actual bricks), they don't absorb heat intended for the workpiece. This is especially useful when silver-soldering, but also quite handy for our present purpose. They are also inexpensive and so perfect for the job.

We set up our hearth outdoors, on a gravelled area near to our workshop (**Photo 38**). I am wary of using a piped propane torch indoors after meeting someone in another club who had done so, not realising there was a pin-prick hole in his hose pipework. The resulting explosion not only wrecked his workshop, but also caused him a permanent disability. On occasions when we have used it indoors (due to inclement weather, for example), we have always worked near to a large, open, garage door!

The torch we used was a Sievert type with a 'roofers' nozzle (the largest available) and propane gas. Oxy-propane would make the process even quicker, but we are devoid of such luxuries and oxy-acetylene is, frankly, dangerous (in my view) unless you are trained and know exactly what you are doing (which we don't!).

Building our hearth as shown in Photo 38, with 'walls' as opposed to just a planar surface, contains and reflects the heat, speeding up the heating process. It can, however, create a degree of 'blowback'/reflection of the flame and suitable clothing and thick (not cheap!) welder's gauntlets should be worn and your face should be kept well out of the way. Undertaking the heating process at arms-length is a good idea.

After a few minutes of heating, the part should begin to turn blue. This should occur at a temperature of 300 to 400 degrees C, comfortably above our 200 degrees C 'design' temperature (even accounting for the plus 15 degrees C outside temperature on the day we did this).

This margin also allows for the cooling which will inevitably take place in the (in our case, fairly significant) journey from hearth to wheelset (the wheelset was clamped in a vice in the workshop). Note that, ideally, the whole of the tyre should be uniformly a nice shade of blue, however this can be difficult to achieve in a rudimentary outdoor hearth and a decent approximation is fine, for our purposes.

Once the tyre is up to temperature, it can be carried to the wheelset. We used a set of mole-grips, 'snapped-on', for this purpose, to minimise the chances of dropping such an extremely hot part onto our rubber flooring. The tyre was then simply placed carefully onto the wheel (**Photo 39**) and the mole-grips disengaged quickly thereafter.

The tyre could then rest on the wheel, with gravity keeping it level (and the shelves machined into the wheel and tyre stopping it from falling past the wheel and on to the vice or bench). The tyre was then left to cool – this takes a long time, as both the tyre and the wheel have large heat capacities. The temptation to 'check if it's on tight' must be resisted until the whole piece is only decently warm to the touch (as a guaranteed means of ensuring that everything is sufficiently cool).

The other temptation is to turn the wheelset over, ready to fit the other tyre – again, this temptation should be resisted until the whole is, essentially, cold, for two reasons:
1) It guarantees that the first tyre won't fall off the wheel (or, worse still, move slightly), due to it not having finished shrinking.
2) It ensures that the second wheel is no longer partially-expanded, due to the heat conducted from the first wheel. If the second wheel is hot, its (expanded) tyre may not fit or, worse still, get stuck halfway. We have had a bitter experience of something similar happening with an expanded-fit wheel on an axle, as regular readers will know!

All being well you will end up with something that looks like **Photo 40**.

Tread carefully

Once both tyres are in place, the fun part can begin – machining the tyres to profile on the lathe (**Photo 41**). Again, a 'between centres' machining set-up was used, with the same configuration as described previously. ▶

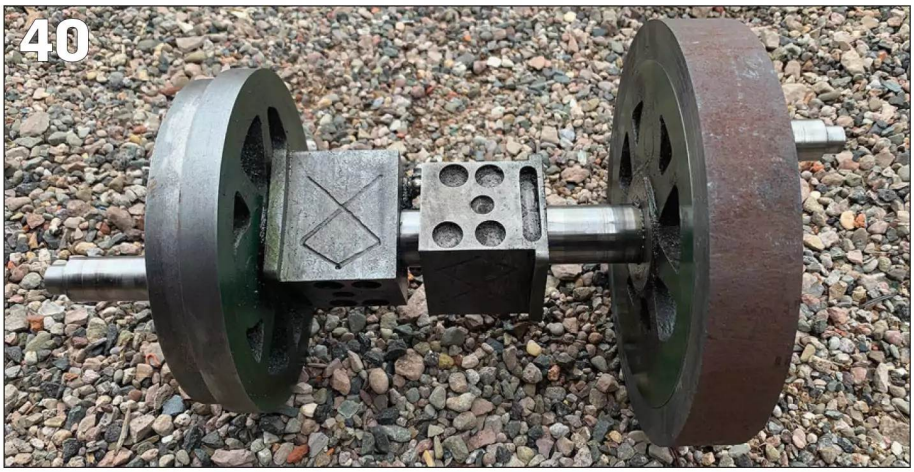


PHOTO 36: Rendering of one of Tom Rolt's pony truck wheels.

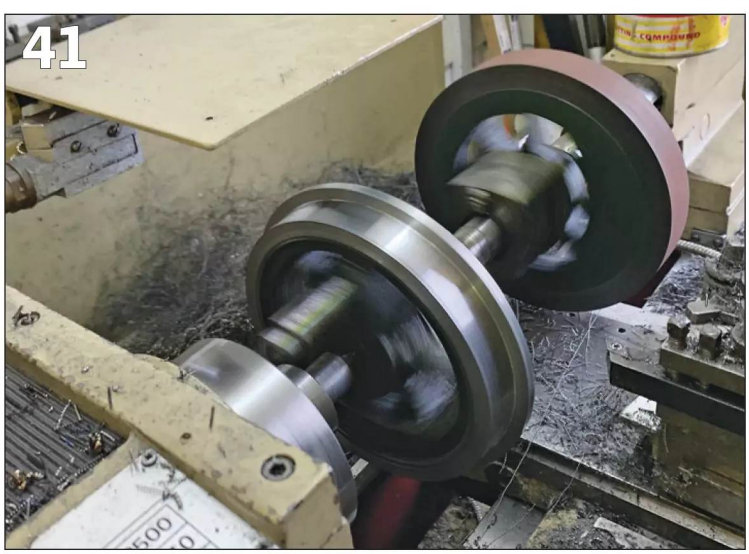
PHOTO 37: Pony truck wheelset after press-fitting the wheels, but prior to final machining.

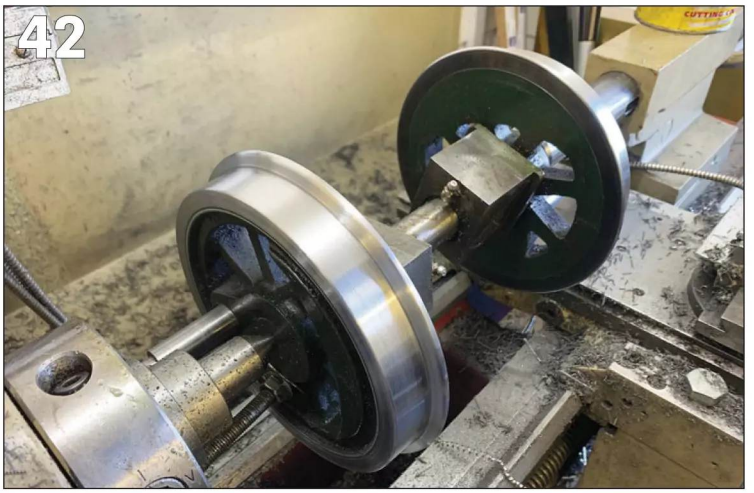
PHOTO 38: Expanding the tyre – starting to turn blue...

PHOTO 39: Placing a tyre on a wheel. Note that it has cooled somewhat in its journey from the hearth – it is clearly no longer blue!

PHOTO 40: One tyre is now in place.

PHOTO 41: Machining the first wheel profile.





Note that, as the tyre was somewhat wider than required, due to the material blank being generous, it was necessary to machine both the face and the tread of the tyre. This obviously needs doing on both tyres (**Photo 42**) and for both wheelsets – all in all, quite a few hours of machining.

Credit where it is due, Matthew undertook all of the machining operations, both of the original blanks and of the wheels and tyres – we had a wet week during his summer holidays (one of many, sadly) and it kept him quiet... This created a lot of swarf, some of which is shown in **Photo 43**. The only part I managed to do was turning the radii on the flanges, which created almost none.

Eventually, two complete wheelsets emerged from the fog of vapourised cutting compound, ready for a coat of paint and re-fitting (**Photo 44**).

Wheel meet again

The final step is to refit the wheelsets to the loco. In the case of Tom Rolt (as with many other locos, we expect) this is made slightly difficult by the need to insert the springs whilst also positioning the (heavy!) wheelset and axleboxes into the horns (**Photo 45**).

Also, there are four springs per axlebox and they are all 'retained' (or not, as the case may be) by friction alone. As you may guess, retaining eight springs simultaneously by friction (or gravity, if inserted into the axleboxes) whilst trying to position the axleboxes into their respective horns, proved to be somewhat frustrating, even with two of us to do it. We sought a better solution.

What we came up with was the use of our favourite little pieces of modern retentive technology: neodymium magnets. These are small enough to fit into the gaps between the springs (**Photo 46**) and still easy enough to remove when no longer needed (**Photo 47**). They are easily strong enough, in terms of magnetic flux, to retain the springs, even when suffering the occasional knock when the axleboxes are manoeuvred into place.

Photo 46 and 47 also show a second technique we employed – we attached each horn-stay loosely by a single bolt, so that it could quickly be pivoted into place when its respective axlebox had been inserted far enough. This was a boon, since the axleboxes needed to compress the springs slightly even at their lowest position. Once the axleboxes were in position,

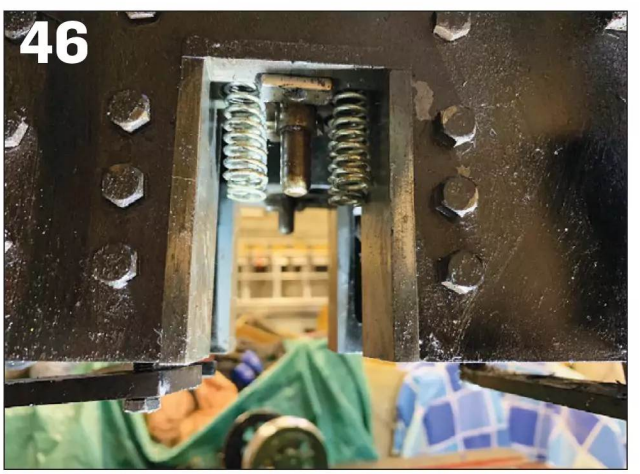


PHOTO 42: Second wheel almost there.

PHOTO 43: Cleaning the lathe took a while – somehow this always seems to be dad's job...

PHOTO 44: Completed wheelsets ready for painting and re-installation

PHOTO 45: Re-inserting the springs

PHOTO 46: Use of the Keningtons' favourite neodymium magnets to hold the springs in place...

PHOTO 47: ...they are a little awkward to remove, but save a lot of searching for lost springs during re-assembly.

PHOTO 48: Re-fitting the horn-stays – the new pony truck wheels can be seen on the right of the picture

PHOTO 49: Finally, back on the track at Hereford – a test-lap before public running. The riding truck colour scheme matches Hereford's carriages and not the loco (at least, not yet...).

the magnets could be removed using a bent piece of thick wire (or an Allen-key). The magnets we used have a hole through their centre, which made the process of 'hooking' them a little easier. Finally, the horn-stays were tightened up using all four bolts (Photo 48).

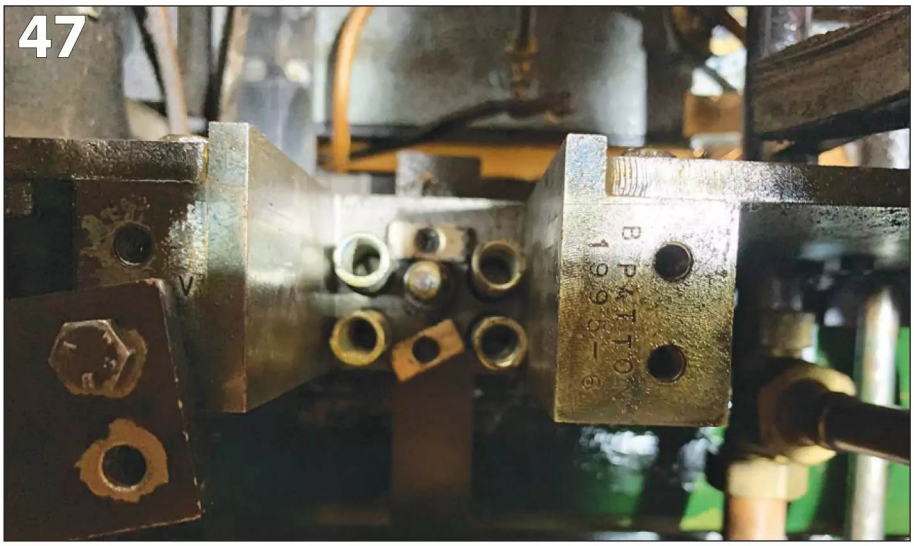
Track changes

Having removed the loco from its stand (as described previously in EIM), all that remained was to take it to our track and test it out (Photo 49). We did, of course, elect to do this on a public running day, so no pressure (other than in the boiler, of course)...

We were actually testing a few changes at the same time, including a cleaned and serviced oiler (worked a treat), a completely stripped and re-built steam brake complete with new O-rings (the loco stopped on a sixpence) and an improved whistle valve – no leaks, but no actual whistle sound either! Back to the drawing board on the latter...

As you can probably guess from the fact that this is the penultimate paragraph, all worked well (other than the silent whistle...). The wheels and their new tyres suffered no traction issues, either tyres slipping on wheels or on the track, even with a full passenger load. They negotiated the points faultlessly and were not worn by the steam-brake (in part because this was now releasing properly).

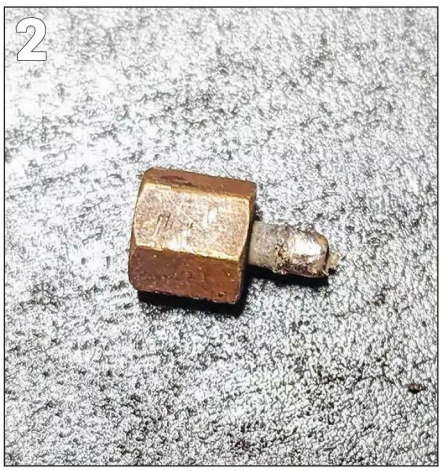
We had endured no mishaps in the making of or, more pertinently, the fitting of, the tyres and my sleep patterns could return to normal. Thanks are definitely due to Matthew for the monumental amount of machining he undertook during this project – he's definitely hired. EIM

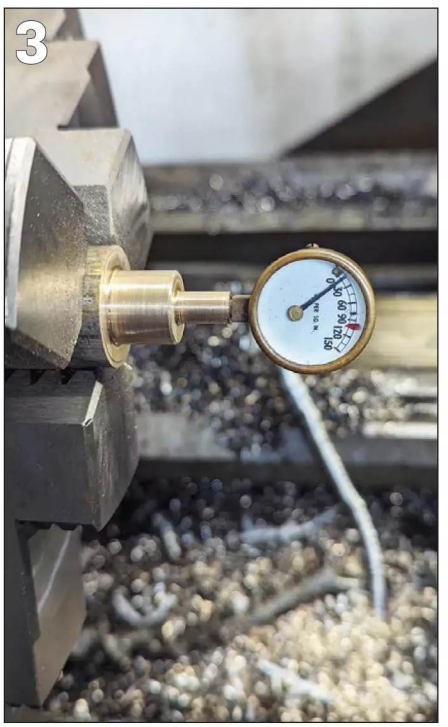


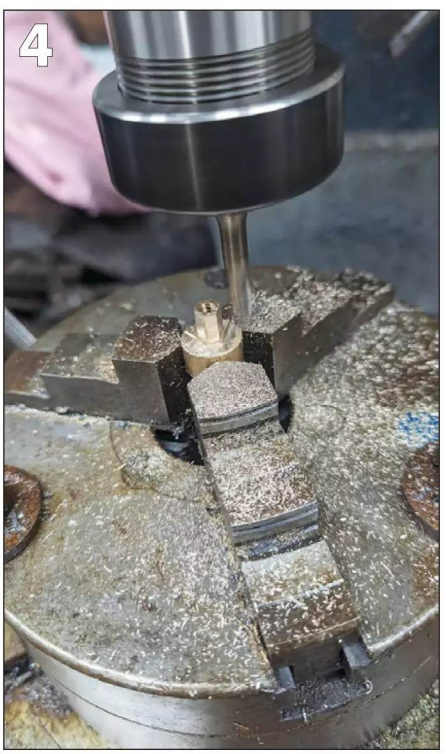
Crossing palms with silver...

A boiler test on a Holmside sets Harry off on a leak-chasing regime, and offers plenty of opportunity for him to refine his silver-soldering technique...

BY **HARRY BILLMORE**







The boiler test on my 7¼-inch gauge Holmside locomotive that was carried out in November had revealed a few leaks that I wanted to attend to, the worst one being on the pressure gauge union. With the test out of the way I nipped up the union and of course stripped the threads in the union nut. With boiler tests I always dislike touching slight weeps on fittings for precisely this reason!

So I whipped the pressure gauge pipework off, heated up the pipe enough so the adapter piece came free from the main pipe and set about making a new union nut – I know they are readily available from many suppliers, but I like making things where I can.

Bigger is better...

A quick root around in the offcuts bin produced a piece of bronze bar – it was grossly oversized but also the only bit that I had available, so I put it in the lathe and turned it down a long way. A piece at the end was machined to the dimensions over the corners of the hex of the nut, followed by a piece behind to a larger diameter to hold in the chuck of my rotary table.

I drilled and tapped it to size, making a quick check to ensure I had got the depths correct so the union would seal before hitting anything

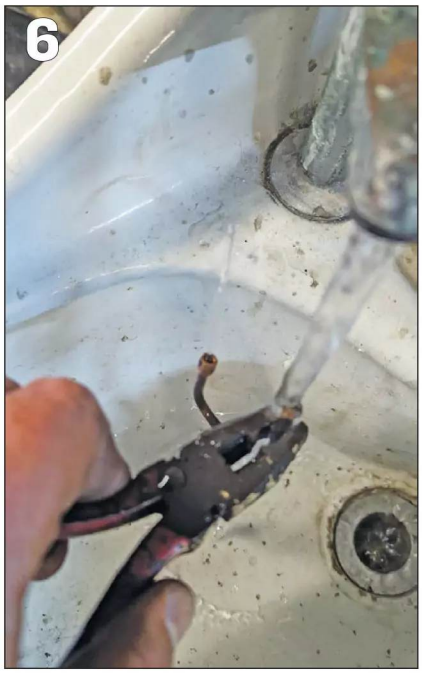
PHOTO 1: Pressure gauge pipework showing the offending union nut.

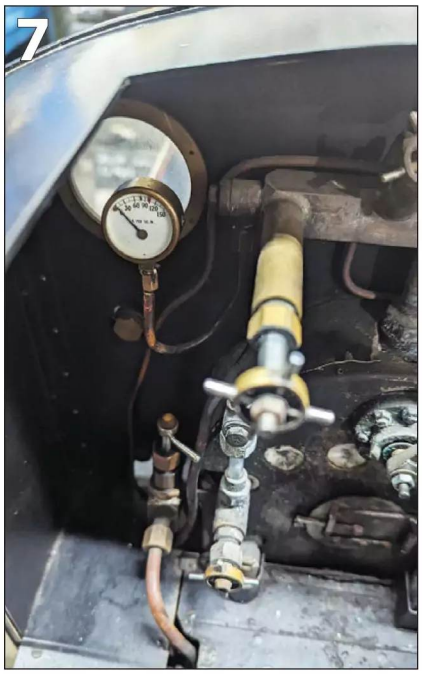
PHOTO 2: The adapter piece was quickly unsoldered from the remainder of the pipework.

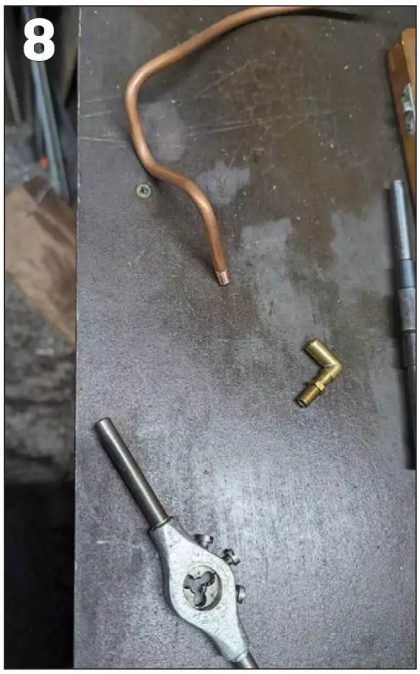
PHOTO 3: A quick bit of turning of a piece of bronze from Harry's offcuts pile produced a blank for the union nut.

PHOTO 4: Machining the hexagon flats onto the blank.

PHOTO 5: The union nut ready to reassemble onto the pipework, somewhat smaller than Harry normally deals with!







on the gauge, and then parted the piece off.

Heading over to the mill I set up the rotary table and milled the flats for the hex, creeping up slowly on the finished size. I could then put the piece back in the lathe and part the nut off – I find it very satisfying making small components like this, it is very different to the size of parts I normally work with on the 6-inch scale locos of the Fairbourne Railway.

With the nut completed I then set the adaptor piece back into the main pipe using a pair of pliers and a torch on the pipework – the previous silver solder was enough to flow back into itself and form a good joint. A quick ▶

"With the test out of the way I nipped up the union and of course stripped the threads in the union nut..."

PHOTO 6: Cooling the freshly soldered pipework, this also helps remove the flux.

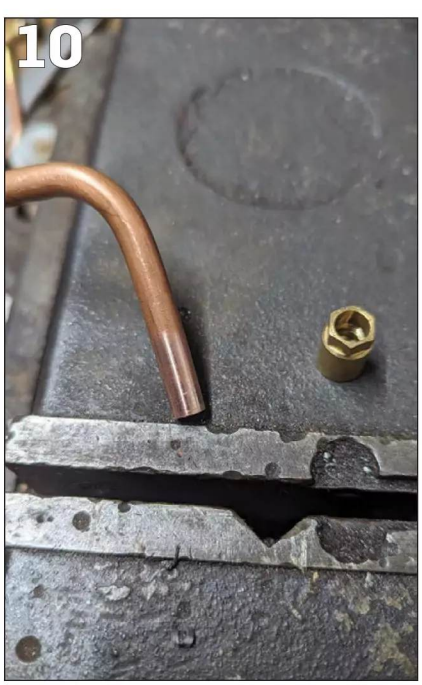
PHOTO 7: The pressure gauge reinstalled and tightened down.

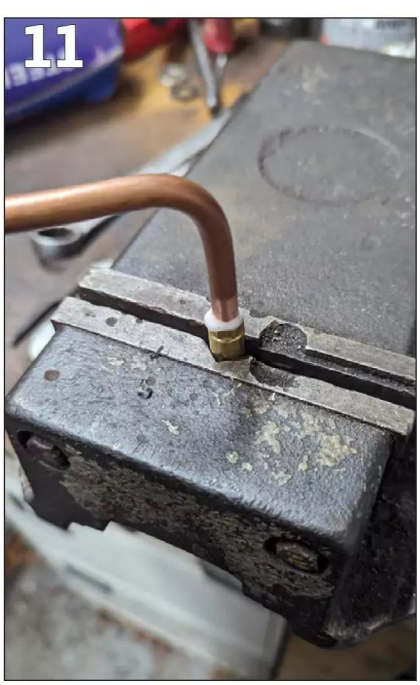
PHOTO 8: Cutting the ¼-inch x 40mm thread onto the pipework Harry bent up some time ago.

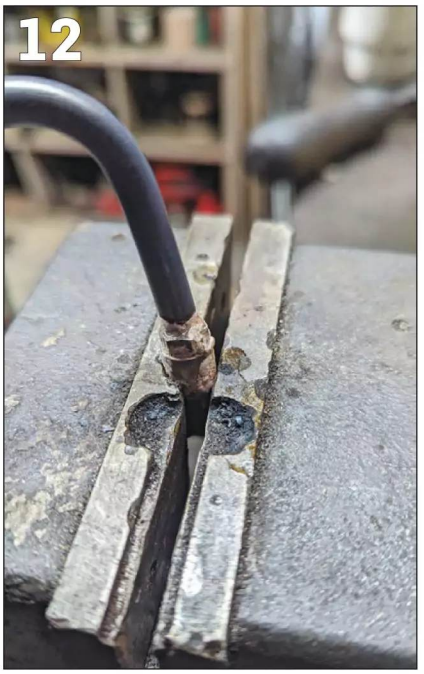
PHOTO 9: Harry likes to hold straight pieces of pipe that need threading in a lathe chuck rather than try and do the job by hand.

PHOTO 10: A bit of wire wool cleans up the pipe for soldering.

PHOTO 11: Just the right amount of flux added to the joint before heating everything up.







"I have to use the lathe chuck to hold the piece, otherwise I end up putting more kinks into it than I can remove..."

PHOTO 12: In this picture you can see where Harry has added way too much solder at too low a temperature.

PHOTO 13: A bit of filing hides the worst of the mess.

PHOTO 14: This is what Harry was aiming for, a much neater joint.

PHOTO 15: The exhaust pipework plumbed into the smokebox side.

PHOTO 16: The ejector mounted in place just by the front of the cab sheet.

PHOTO 17: The exhaust piped up into the petticoat pipe.

quench to cool it off and to get most of the flux off and I could refit it all on the engine.

I then turned to the loco's ejector exhaust pipework, which required a load of threading. I prefer doing most of this by hand, once you have enough practice I find it's easier to get better results than using a lathe. However for straight bits of pipe I have to use the lathe chuck to hold the piece, otherwise I end up putting more kinks into it than I can remove!

Once all the threading was done I could then start silver soldering, remembering the six Ps – proper preparation prevents piss poor performance... A good clean surface, adequate work holding and the right amount of flux in place usually makes for a good joint.

Once everything is all cleaned up and fluxed, (remembering that silver solder will tend to flow to fluxed areas, so if you don't want solder somewhere, don't get flux on it) I use a small MAPP and air torch to heat everything up until the flux goes like glass, then a small touch of the solder is usually enough.

File under poor

Of course on my first attempt I put way too much solder on the job and it ran everywhere and looked a right mess. Some work with a file brought it up to a point where it just looked a bit poor instead!

With all of the components soldered together, I fitted the pipework to the engine before spending a considerable amount of time bending up the pipe to send the jet up the chimney – this is complicated by the relatively tight space above the blower ring and below the petticoat pipe due to the lempor design of draughting.

All I have to do now is finish the vacuum controls in the riding truck and I can finally give my locomotive a test run! EIM

Midlands Garden show ready to roll

THE MODEL RAIL SHOW FOR LARGER GAUGES
MIDLANDS GARDEN RAIL SHOW
0 GAUGE, G SCALE, GAUGE 1, 16MM & MORE...

Confirmed specialist suppliers include;

- Accucraft UK
- All Components
- Amazing Little Trains
- Barrett Steam Models
- Blackcat Bridges
- Bole Laser Craft
- Bootlane Works
- Brandbright
- Brunel Models
- Brushes 4 Models
- Chalk Garden Rail
- Chuffed 2 Bits
- Coach & Wagon Works
- Elaine's Trains
- Endon Valley Custom Decals
- GardenRail Magazine
- Garden Railway Specialists
- Gartenbahn Supplies Ltd
- John Sutton Books and Models
- Just the Ticket Engineering Supplies
- Kippo Models
- Kontax Engineering
- Live Steam UK
- Loco-Boxes
- Malc's Models
- Mamod
- Miniature Steam Models
- Model Engineers Laser
- Peak Tools
- Railway Graphics.com
- SMTF Model Shop
- Sparklebright
- Steve Currin Books
- Tenmille Products
- Timpdon Models
- Tony Green Steam Models
- Venturer Models

The long-established Midlands Garden Railway Show this year takes place on 2nd and 3rd March at its traditional location of the Warwickshire Event Centre near Leamington Spa, again sponsored by **Engineering in Miniature** and our sister magazine *GardenRail*.

The event is known as 'the model rail show for larger gauges', which might have some readers wondering why we get involved, but it's for a very good reason. While the likes of Gauge O, Gauge 1, 16mm and G-Scale might be the larger scales for those who do their railway modelling indoors, they also have a sizable following among the model engineering community. These are our smallest scales but also ones enjoyed by many typical **EIM** readers – in modern times of downsizing and ever more limited space at home (or indeed budget) to indulge in the larger scales, the scales on display at this event hold a lot of appeal.

There are many advocates producing excellent model engineering in these scales, and clear evidence of their increasing popularity is the number of 32 and 45mm gauge running lines being added to the facilities of many a model engineering society – rest assured **EIM** readers will find plenty to interest them at the event.

Organisers promise a varied range of large-scale and garden model railways with a dozen layouts confirmed in scales up to Gauge 3 – the 'more scenic' sister scale to 2½-inch gauge. Both the Gauge 3 Society and National 2½" Gauge Association will also have their own display stands, as will the Bromsgrove and Coventry model engineering societies. And with a selection of 16mm scale narrow gauge layouts in attendance plus the Gauge 1 'Midsummer Norton' you can guarantee plenty of live steam.

Those enthused by what they see will also find plenty to help them make a start in whichever of the scales they choose. As the list at right shows, numerous specialist suppliers will be present with a vast array of products giving potential purchasers the chance to actually view locomotives, rolling stock and trackside accessories and see what they are buying rather than just relying on illustrations online.

The venue includes on-site catering facilities with a restaurant enabling visitors to enjoy a full day out.

More details of the show together with advanced ticket booking facilities are at www.midlandsgardenrailshow.co.uk – also included is the full show guide which can be downloaded from the site.

Finally the essential information – the show is open from 10am to 4pm on each day and admission is £11.50 adults, £11.00 senior citizens and £5.00 children (5-14).

Photos from 2023 show by Phil Parker

End of the line for Astbury Railway

The UK miniature railway scene lost another member in January when the nascent Astbury Light Railway operated its last trains.

Officially the 10¼-inch gauge line was described as a portable railway set up at Glebe Farm in Astbury, near Congleton in Cheshire. Owner Adam Jeffrey had established a 700-yard long route in 2017, climbing out of the farm to a viewpoint over the Manifold valley. It was described as the "steepest adhesion-worked railway in Britain" with the gradient said to be 1 in 9!

Adam made continued efforts to obtain planning permission for the line to become permanent, which would allow him to build proper locomotive facilities to replace the shipping container the stock was operated out of. However the local council rejected the applications, arguing that the line "would detract from the open-ness of the Green Belt land."

Before closure the line ran one final weekend of services over the weekend of 20th-21st January. The site has hosted some fascinating locomotives, including Exmoor Steam Railway-built 'Pendragon' and 2-6-0 'Norfolk Pioneer' built in 2011 by the chief engineer of the Wells & Walsingham Railway in Norfolk. Most recently they were joined by a historic bo-bo diesel built in 1960 for the Shillingstone Light Railway of Sir Thomas Salt, first preservation chairman of the Welshpool & Llanfair Light Railway who saw it through several early challenges. What will happen to this stock has not yet been revealed.

Photo from final weekend by Donald Brooks

Wales/London loco swap

How important is a quarter of an inch in gauge? Not desperately, if you have enough width to play with...

The 12-inch Ruislip Lido Railway and the 121/4-inch gauge Fairbourne Railway, where EIM technical editor Harry Billmore serves as chief engineer, will be swapping stock later this year.

Fairbourne's Darjeeling-style 0-4-0 'Sherpa' will be gurest of honour at Ruislip's Steam Gala on 4th-6th of May, and three weeks later the Greater London line's Penrhyn Hunslet-style loco 'Mad Bess' will head the other way to mid Wales to join in the Fairbourne Gala on 25th-27th May, along with Bassett-Lowke built former Fairbourne resident 'Count Louis' which will be celebrating its 100th anniversary.

More details of both events will be available on the websites of the two railways, www.ruisliplidorailway.org and www.fairbournerailway.com

Midlands ME show confirms October dates

Meridienne Exhibitions might be rather busy organising the Midlands Garden Rail Show this month (see page 41) but plans are already being made for what is without doubt the major show of the model engineering year, the Midlands Model Engineering Exhibition.

This year's show will take place from Thursday 17th to Sunday 20th October at its usual venue of the Warwickshire Event Centre near Leamington Spa.

Meridienne tells us that this year there will be nearly 40 of the leading model engineering specialist trade suppliers at the show, alongside hundreds of fascinating models showcased in the competition and display classes and on nearly 30 club and society display stands, as well as the steamers on the outside display areas around the exhibition halls.

The show website is up and running at www.midlandsmodelengineering.co.uk and advance ticket booking will soon be available – get your diaries out!

■ There is still no confirmed date for the 2024 Harrogate show though we have heard that it might be even later than the May date indicated to us earlier in the year. More details when we get them.

Open House at Station Road

Well-known miniature engineers Station Road Steam are holding a works open day on Saturday 24th March from 10am to 4pm, showcasing the firm's range of new-build locomotives, including 'Stafford', 'Feldbahn', 'General Gordon' and a new design 'Mazeppa', which will make its debut on the day.

The current batch of locomotives, due for delivery at Easter, will be on display, along with one of the larger, 'Estate Range' locos.

Visitors will also be able to try their hand on the regulator of a Stafford – there will be an engine available in steam on a short test track outside the works.

The parts shop will be open; help, advice and technical assistance will be on hand from the design team for existing owners and those considering their first new engine.

Parking is available by kind permission of North Kesteven District Council at its depot adjacent to Station Road Steam's premises. Light refreshments will be available throughout the day.

Admission to the event will be strictly by pre-booked, free-of-charge ticket. This is due to limitations on parking, plus we are told to give the organisers an idea of how many sticky buns will be required! To obtain tickets, see the advert on page 51 of this issue.

Calm before the storm...

Club tracks enjoy their winter slumbers but behind the scenes there is plenty going on.

COMPILED BY **ANDREW CHARMAN**

This month's selection of club and track updates is being compiled on almost the last day of January, a strange time in the model engineering calendar – while by the time you read this page many clubs will be beginning to think seriously about opening up their tracks to the public once more, especially with Easter being early this year in late March, I'm writing in what seems that period of limbo between the busy festive period and a new running season, perhaps evidenced by the number of club journals arriving at EIM Towers this month being rather more selective than is the norm.

Of course very few model engineers are hibernating – many are enjoying time in their workshops, especially if they are as warm and comfortable as the one Rich Wightman has been describing the build of in our pages over the past couple of months. Delve into the club journals and there are plenty of projects on the go, which is always good to see.

Just one more..

Very much indicative of this point is the 'Model of the Month' feature in the latest edition of *The Newsletter* from the York ME. Member Richard Gibbon has spent the last four years building a 5-inch gauge version of a 2ft gauge Corpet 0-6-0. Apparently this is the 14th loco that Richard has built, and he had no intention of going beyond 13 before he enjoyed a day out to the Statfold Narrow Gauge Trust near Tamworth and saw the real thing, the 1878-built 'Minas de Aller No.2' in action.

"I was reminded recently that when I had completed my beautiful Isle of Man Beyer Peacock locomotive 'Sutherland', I had promised my wife that I would not build another big model locomotive! Oh dear!" Richard is quoted as saying in the York newsletter. "This machine is different in so many ways that I fell in love with it instantly and the thought of building it gnawed away at me for a long time until I found a way to do it."

Well we think many people will be glad he found a way, as the result looks to be seriously impressive, shown in its unpainted state, a masterpiece of copper and brass – the view of the first steam test in Richard's workshop is a particularly atmospheric picture...

"I had promised my wife that I would not build another big model locomotive..."

LEFT: York member Richard Gibbon with the 14th steam locomotive he has built, a truly impressive 7¼-inch gauge example of a Corpet narrow gauge loco.

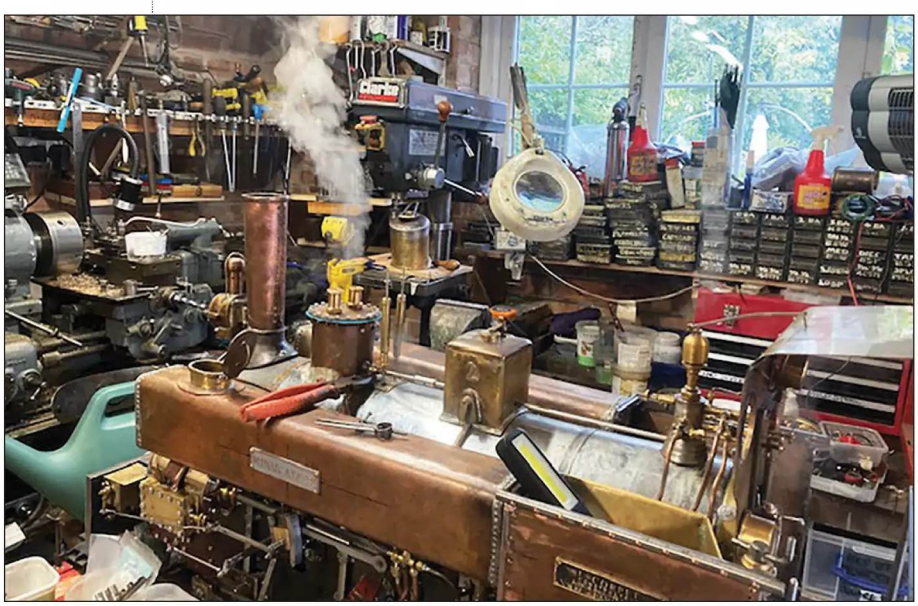
BELOW: The first steam test of the Corpet in Richard's garage workshop made for a highly atmospheric photograph...

Photos: Richard Gibbon via Roger Backhouse, York ME

Among the many challenges involved in the build was having to completely remake both cylinder blocks after the first fabricated examples proved a bit of a cul-de-sac. Richard also pays tribute to the CAD design skills of fellow member Mike Pinder, who was able to transfer the basic exterior look of the "Paris-built, Swiss-designed Spanish coal mine loco" to a well-proven boiler design that Richard had built twice previously. Your editor can concur with the skills of Mr Pinder as when I was editing my first model magazine, the journal of the Association of 16mm Narrow Gauge Modellers, Mike used to supply me with superb scaled general arrangement drawings of various obscure narrow gauge locos...

By the way once Richard's loco hits the track we reckon he will be constantly explaining the name. It's called 'Saucy Jo Nut' – actually an anagram of "Can you just" which is apparently the three words most often uttered by people dropping into Richard's workshop over the past 70 years – love it...

One sad aspect from the York newsletter is that it is the last issue ▶



edited by Roger Backhouse – you've done an excellent job Roger, producing one of the most wide-ranging but always interesting journals around. Mind you this fellow editor appreciates that everyone needs a break after a while!

Last year your editor had a very enjoyable day out at the 90th anniversary celebrations of the **Lincoln & District ME**, which has a ground-level track of a nice length running around the perimeter of the public playing field in the village of North Scarle, around 11 miles from the city of Lincoln.

Not just any talk...

Lincoln members have traditionally run trains on Sunday mornings alongside car boot sales held on the playing field but we hear welcome news of an experiment in 2024, running also on certain Saturday afternoons in July and August. These are described as "enabling us to act more like a model engineering society instead of an adjunct to the car boots" and the latest newsletter brings news of another move in this direction, a new series of winter talks. These are scheduled to take place in an interesting venue, a room adjacent to the cafe of the local Waitrose supermarket! It's always good to hear of such efforts by clubs and we hope they are a success.

Your correspondent was initially perturbed on opening the latest *Goodwin Park News* from **Plymouth Miniature Steam** to read of "vandals" descending upon the track, until he realised that this is the way the club describes its permanent way gang! Of course in marked contrast to the activities of the average vandal much good work has been done by the gang over the winter, including completely replacing a section of the running line with a new concrete base added. No doubt such scenes of winter activity have been replicated on club tracks right across the country.

Joining the list of events to look forward to, if one was asked to name miniature engineering pioneers then both Henry Greenly and Wenman Joseph Bassett-Lowke would very likely be among the first answers. The **Northampton SME** is keeping the memory of these major figures in our vocation alive by holding the second Bassett-Lowke & Henry Greenly Rally on Saturday 18th May at their Delapre Park track in the Midlands town.

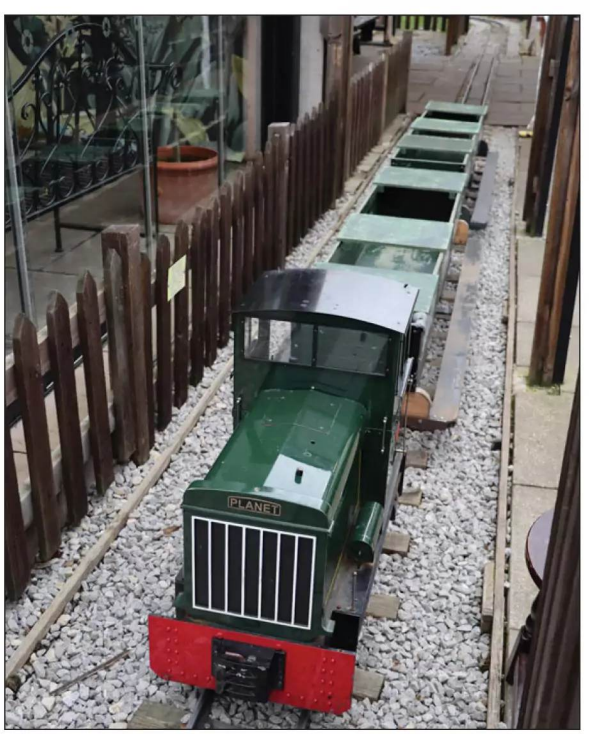
Visiting locos to the event will be welcome in 7¼, 5 and 3½-inch gauge to run on the club's raised and ground-level tracks, while there will be Gauge 1 and Gauge 2 running in the marquee and a 45mm and 32mm garden railway available. For more details contact the club through their website at www.nsme.co.uk

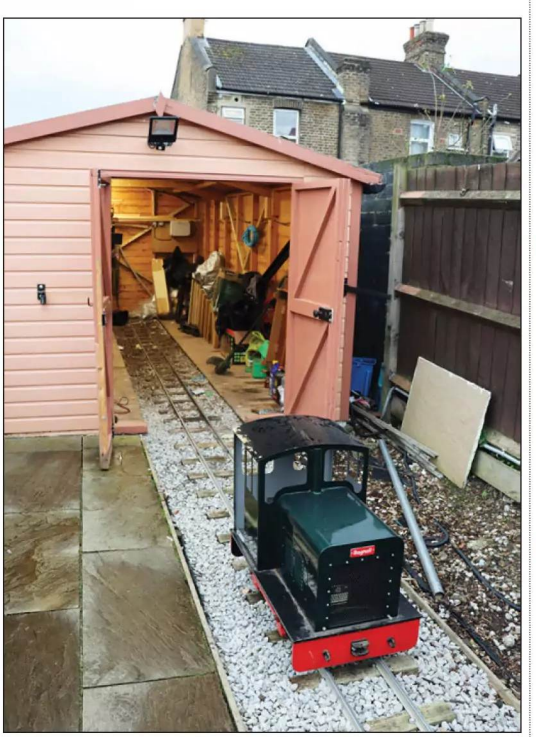
Down the local

Away from the clubs and onto the more general tracks, regular **EIM** correspondent and Narrow Gauge Railway Society miniatures editor Jonathan James has been on his travels again, seeking out lines that were hitherto not widely known, and as he says miniature railways pop up in the most unusual locations. The **Holly Tree Railway** is a prime example, being located in a small pub garden in east London.

The line opened in 2019 in the grounds of The Holly Tree pub near

"More like a model engineering society instead of an adjunct to the car boots..."





ABOVE LEFT: The impressive facilities at the Lincoln ME will see some more use in 2024. *Photo: Andrew Charman*

FAR LEFT: Ready for the next load at the Holly Tree Light Railway, a 7¼-inch gauge line which offers the additional attraction of being located at a pub....

LEFT: The Holly Tree line boasts simple but effective loco maintenance facilities.

Photos: Jonathan James

Forest Gate, which Jonathan tells us is a short walk from Forest Gate Elizabeth line station and Wanstead Park London Overground station.

The 7¼-inch gauge line forms a simple circuit, with one station called Holly Tree Halt and a spur to the shed. The railway has two battery locomotives and two carriages.

Jonathan kindly adds a review of the pub which he describes as family-friendly and popular, offering a selection of food. Train tickets can be purchased from the bar and trains usually run at weekends, subject to weather conditions, but if you are thinking of visiting it's worth checking in advance.

Jonathan also called in to another steadily expanding 7¼-inch gauge line, the **North Weald and District Miniature Railway** which is located in the grounds of Harlow Garden Centre in Essex.

This line opened in September 2019 and has gradually been extended, now boasting three stations and a tunnel. There is also a small gift shop, with a café and toilets available in the adjacent garden centre. The journey takes about 12 minutes and the adult fare is currently £2, Jonathan commenting that a nice paper ticket is issued to travellers. The railway has an impressive collection of petrol, battery and steam locomotives and opening times are published on the website (www.nwdmrail.co.uk) and on its Facebook page.

African-style line?

Meanwhile another of our regular correspondents, Phil Barnes, has sent me a plea for assistance with some information he is seeking on a long-lost miniature line, and my response? The readers will know...

Phil has been asked by the younger fraternity at the **South Downs Light Railway** about the 7¼-inch gauge line that was once located at Stopham, near the SDLR's site at Pulborough in West Sussex. "It was known as the Cheals Garden and Leisure Centre (Railway)," Phil adds. "My son volunteers at the SDLR of today and was asked to ask me if I have any info about the 'old' railway which was removed circa 2000. They have some pictures of mine which I took in 1988 and want some info to go with them."

Phil knows that the railway's loco was given as an East African-style 4-4-4 and the bogie carriages were of the open type. The line was reputedly run by a family – can any EIM reader shed further light? If so drop a line to editor@engineeringinminiature.co.uk

Whoops, out of space again – keep those newsletters coming, and if you have any pictures for these pages...

ABOVE: Lots of effort by the volunteers at the North Weald and District Miniature Railway is steadily adding to the appeal of this new 7¼-inch line. *Photo: Jonathan James*

"Train tickets can be purchased from the bar and trains usually run at weekends..."

ON THE TUBE

The website Youtube, which encourages users to upload video clips, 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

■ We regularly ask readers to send in clips they think might be of interest and Steve Self has done just that with something rather newsy, a drone video taken in early January showing the flooding caused by Storm Henk of the River Wensum near to the County School station, which is part of but not connected yet to the standard gauge Mid Norfolk Railway. The clip also shows the progress of the **North Norfolk ME**'s miniature line which is being built at the station. The clip was made on a work day and shows various members at work. Steve adds that so far about 1000 feet of the 1600ft long raised 5 and 3½-inch gauge track has been completed, and the line operates under the title of the 'Wensum Valley Miniature Railway'. **bit.ly/42hJ90u**

■ Staying with the newsy stuff, we report on page 42 on the final weekend of operation on the 10¼-inch gauge **Astbury Light Railway** on 21st January and this video, one of the long-running series of 'Henry's Railway Adventures' features action on the day. Obviously it's tinged with sadness but it does include a remarkable sequence of a double-headed train climbing a gradient which is said to be 1 in 9! **bit.ly/48TDsYS**

DIARY

EVERY SUNDAY

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

Lancaster & Morecambe ME public running, Tarn Lane, Carnforth, LA5 9RX, 10.30am

King's Lynn DSME public running, beside Kaset skatepark, Greenpark Avenue, King's Lynn PE30 2NB, 11am-3pm (also Wednesdays)

Norwich DSME Pop-up trains, Eaton Park, Norwich 11.30am-3.30pm

North Wilts ME public running, Coate Water Country Park, Swindon SN3 6AA, 11am-dusk

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

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

MARCH

02 SMEE meeting, Talk, Why we make models by Roger Backhouse, Marshall House, London SE24 0HW, 2.30pm

02 Tiverton ME monthly steam-up. Chris Catley 01884 798370 (www.tivertonmodelengineering.org.uk)

02 Midlands Garden Rail Show,
03 Warwickshire Event Centre, nr Leamington Spa, details at www.midlandsgardenrailshow.co.uk

05 Bournemouth DSME Tuesday Meet-up, Littledown Pk, Bournemouth, 10.30am

05 Lancaster & Morecambe ME members evening running, Tarn Lane, Carnforth, LA5 9RX, 5pm

05 Romney Marsh ME meeting, The Bure Valley Railway by Andrew Barnes, Rolfe Lane, New Romney, Kent 7.30pm

06 Bradford ME AGM, St James' Church, Baildon BD17 6HH, 7.30pm

06 Bristol SMEE meeting, auction, Begbrook Social Clb BS16 1HY, 7.30pm

08 Tiverton ME meeting, Old Heathcoat School Community Centre, King Street, Tiverton EX16 5JJ.

12 Romney Marsh ME members social afternoon, Rolfe Lane, New Romney, Kent, 2pm

13 High Wycombe ME meeting, Rossetti Hall, New Pond Road, Holmer Green, 7.30pm

16 SMEE Engine Builders Group online talk, subject tba, details from ebgadmin@sm-ee.co.uk

17 Bristol SMEE public running, Ashton Court Railway, BS8 3PX, noon-5pm.

17 Guildford ME Open Day and public running, Stoke Park, Guildford, 2pm-5pm

17 Tiverton ME Sunday steam-up. Contact Chris Catley 01884 798370 (www.tivertonmodelengineering.org.uk)

17 Westlands & Yeovil DSME portable track and steam at South West Main Liine Steam Trust, Yeovil Junction station

18 Lancaster & Morecambe ME meeting, subject tba Tarn Lane, Carnforth, LA5 9RX, 7.30pm

19 Romney Marsh ME meeting, Products of the winter workshop, Rolfe Lane, New Romney, Kent 7.30pm

20 Bristol SMEE meeting, Talk on Goliath, a model of a 1903 French tug boat, Begbrook Social Club BS16 1HY, 7.30pm

23 City of Oxford SME afternoon meet, quiz, Cutterslowe Park, Oxford

23 Romney Marsh ME boiler testing, Rolfe Lane, New Romney, Kent, from 9am

23 Westlands & Yeovil DSME Track running day, Westlands Leisure Centre, Yeovil BA20 2DD, from 11am

24 Lancaster & Morecambe ME boiler testing, Tarn Lane, Carnforth, LA5 9RX, 10.30am

26 Romney Marsh ME first track meeting, Rolfe Lane, New Romney, Kent 12 noon

29 Lancaster & Morecambe ME Easter public running, Tarn Lane, Carnforth, LA5 9RX, 10.30am

30 Bradford ME Easter Bunny public running, Northcliff Railway, Shipley, BD18 3DD, 12.30-3pm

31 Bournemouth DSME MacMillan Local Charity Day, Littledown Pk, Bournemouth, 10.30am

31 Lancaster & Morecambe ME Easter public running, Tarn Lane, Carnforth, LA5 9RX, 10.30am

31 Romney Marsh ME Easter Track Meeting, Rolfe Lane, New Romney, Kent, from 10am

31 Bristol SMEE public running, Ashton
01 Court Railway, BS8 3PX, noon-5pm.

31 31-01 Westlands & Yeovil DSME
01 portable track and steam at South West Main Liine Steam Trust, Yeovil Junction station

APRIL

01 Lancaster & Morecambe ME Easter public running, Tarn Lane, Carnforth, LA5 9RX, 10.30am

02 Bournemouth DSME Tuesday Meet-up, Littledown Pk, Bournemouth, 10.30am

02 Romney Marsh ME Easter Track Meeting, Rolfe Lane, New Romney, Kent, from 10am

03 Bradford ME meeting, 'Low Moor – Ring of Iron' by Mary & Geoff Twentyman, St James' Church, Baildon BD17 6HH, 7.30pm

03 Bristol SMEE meeting, On the Table, Begbrook Social Club BS16 1HY, 7.30pm.

04 Guildford ME Open Day and public running, Stoke Park, Guildford, 10am-5pm

06 SMEE AGM and Talk, Making Battleships by Alasdair Milne, Marshall House, London SE24 0HW, 2.30pm

06 Tiverton ME monthly steam-up. Chris Catley 01884 798370 (www.tivertonmodelengineering.org.uk)

07 Lincoln ME public running for car boot sale, North Scarle playing field, LN6 9ER, 9am-noon

07 National 2½" Association Running Day at West Riding SMS, Tingley WF3 1SD

12 National 2½" Association Running Day at Cheltenham SME, Hatherley Lane, GL51 6PN

12 Tiverton ME meeting, Old Heathcoat School Community Centre, King Street, Tiverton EX16 5JJ.

14 Bristol SMEE public running, Ashton Court Railway, BS8 3PX, noon-5pm.

14 Westlands & Yeovil DSME portable track and steam at South West Main Liine Steam Trust, Yeovil Junction station

15 Lancaster & Morecambe ME meeting, Tarn Lane, Carnforth, LA5 9RX, 7.30pm

17 Bristol SMEE meeting, Talk on 'Joyce', a Sentinel loco, Begbrook Social Club BS16 1HY, 7.30pm.

20 SMEE Rummage Sale, Marshall House, London SE24 0HW, 2.30pm

21 Bradford ME Easter Bunny public running, Northcliff Railway, Shipley, BD18 3DD, members from 11.30am, public from 1.30pm

21 Bristol SMEE public running, Ashton Court Railway, BS8 3PX, noon-5pm.

21 Guildford ME Open Day and public running, Stoke Park, Guildford, 2pm-5pm

21 Lincoln ME public running for car boot sale, North Scarle playing field, LN6 9ER, 9am-noon

21 Tiverton ME Sunday steam-up. see 17th March

21 Westlands & Yeovil DSME portable track and steam at South West Main Liine Steam Trust, Yeovil Junction station

28 Westlands & Yeovil DSME Track running day, Westlands Leisure Centre, Yeovil BA20 2DD, from 11am

PLEASE NOTE all outside events and public running are subject to weather and member availability – 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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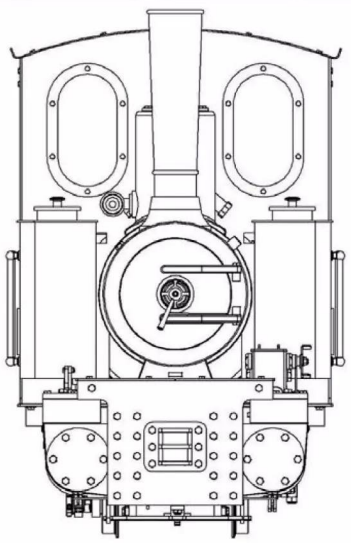

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Colchester Bantam 2000 lathe (long bed) metric leadscrew, Dickson post £4950


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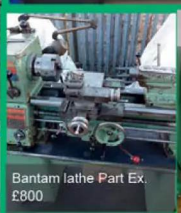
Startrite 24 V 10 + welder bandsaw, nice £1750


Bantam lathe Part Ex. £800

Myford Super 7B lathe, gearbox, power cross-feed, 240 volts + switchgear, 3 jaw chuck + Dickson tooling HARDENED BED £4500.00

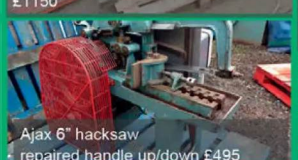

Harrison L5, M250, M300 / Colchester Student 1200 / 1800 lathe change wheels + A&S 1ES milling machine table gears


Wadkin wood lathe 6" centre height x 32" centres + 14" rear face plate on the rear end + 6 3/4" 3 jaw chuck £1150


Clarke Strongarm 10 Tone garage press £200


Eclipse De-Magnetiser 110V £100


Wolf-Jahn lathe + collets j+ two tail-stocks just in! £3250


Ajax 6" hacksaw repaired handle up/down £495


Meddings L1 MK.V drilling machine £2250


Myford Super 7 B lathe £3450

Creuson Morrisflex 240V 8" polisher buffers £825 each


Harrison Graduate wood lathe £1450


Clarke 917 vacuum former £495


Myford 3/4HP 240V resilient mount motor configurated to match a Dewhurst reversing switch already wired + instructions £226


Trugrip collets metric £35 Imperial £30, Marlco 2820 £15 each


Chester Cub 630 6" x 30" centres chucks, steadies hardly used £2950

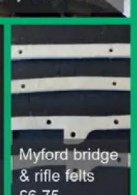

DP / MOD gear cutters JUST £20 each + MORE JUST ARRIVED! Hundreds in stock!


Myford Speed 10 lathe, 58-2000rpm , 3 & 4 jaw chucks, lead-screw clutch, stand, tray and blocks, 240V £2000

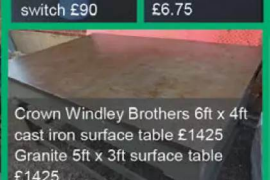

Harrison L5 240V 4 1/2" x 24" ABC box 4 way tool post Part Ex £850


HME Hearth just arrived from education 3PH / mains gas £500

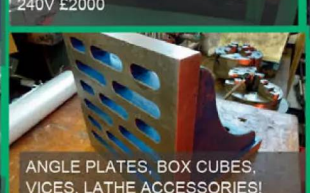

Tripus 240v switch £90


Myford bridge & rifle felts £6.75


Norton Deep throat No.6DB fly-press 12" throat x 9" height £950 +++ FLYPRESS PUNCHES AVAILABLE

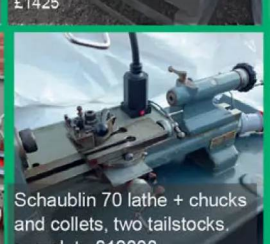

Crown Windley Brothers 6ft x 4ft cast iron surface table £1425 Granite 5ft x 3ft surface table £1425

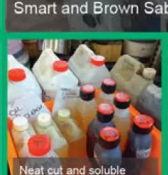

Smart and Brown Sabel lathe £950

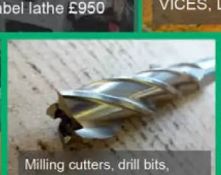

ANGLE PLATES, BOX CUBES, VICES, LATHE ACCESSORIES!


Myford gearbox unused £1000


Harrison M300 lathe £3950


Schaublin 70 lathe + chucks and collets, two tailstocks, complete £12000


Neat cut and soluble cutting oils £10 each


Milling cutters, drill bits, chasers, DOC cutters etc.


Colchester Student lathe 6" x 24" metric / imperial gear-box, gap bed Part Ex £850


Picador Pullies just arrived from £12.00

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