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THE MAGAZINE FOR MODEL ENGINEERS

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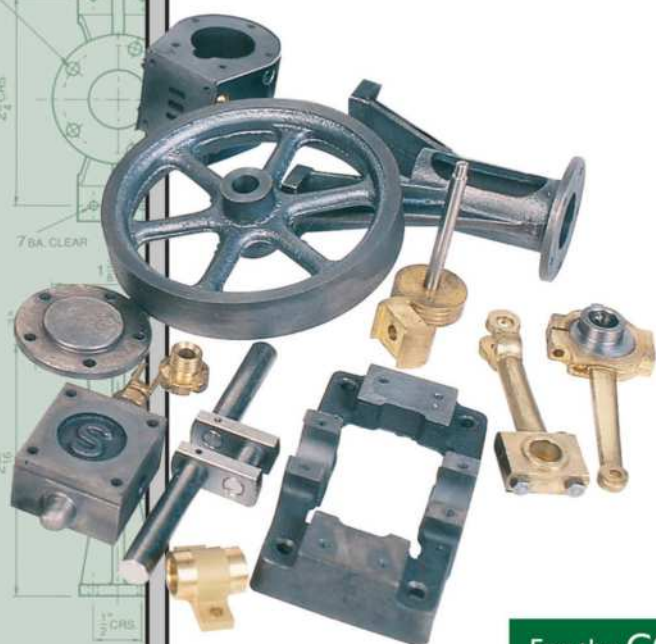
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EDITORIAL

Trying to avoid falling into a black gold black hole...

Welcome to another packed issue of **EIM** – June already! Where is the year going to? Certainly things seem to be getting very busy on the model engineering scene, especially on the club front, which is a good sign.

Many readers will know that I also edit **EIM**'s sister magazine *Narrow Gauge World*, and one can't go anywhere on the full-size heritage railway scene at present without being drawn into conversations about the subject on everyone's mind – coal supplies. You see the developing issues over future supplies suddenly came to a head a couple of months ago when the UK's last remaining pit producing coal suitable for steam locomotives, Fros-y-Fran in south Wales, had a breakdown of its washing and grading equipment, and as it was due to close anyway later this year, decided the equipment was uneconomical to repair. Railways expecting coal supplies were suddenly forced to search elsewhere, and that often involves sourcing the stuff from – Russia... Not really a current option for practical or ethical reasons.

So there's quite a lot of chaos going on at present, and most railways are stepping up their efforts to trial various new 'eco coal' alternatives coming onto the market. Trials with these have in many cases yielded promising results, but the stuff burns more quickly, and costs twice as much as traditional coal.

The situation is volatile (no pun intended), with some observers predicting that the changing shape of the energy market to move away from energy supplied from Russia could have other effects, including an extension of Fros-y-Fran's working life. But it's clear that a move to more sustainable fuel supplies is inevitable.

This had me thinking – we ran a feature on the Andover ME's trials of eco-coal back in the November 2021 issue, but we haven't generally heard of any wholesale moves towards a coal-less future in the model engineering world. And this is something we will need to be taking on board at some point in the not too distant future. So is your club looking at more sustainable fuel? Have you tried any? If so I (and I'm sure other readers) would be interested to hear about your experiences...

Andrew Charman – Editor

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FRONT COVER

It's not just about the locomotives you know! This month's issue describes this prototypically correct 7¼-inch gauge Penrhyn Quarries slate wagon, designed and built by our tech ed Harry Billmore. Hunslet 0-4-0 'Linda' makes for a suitable backdrop. Photo: Simon Mayor

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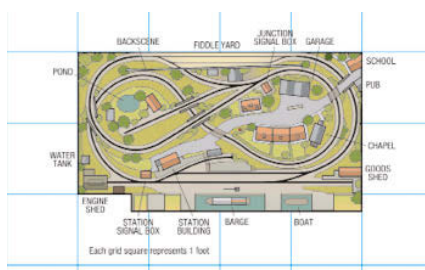


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The GWR 61xx Class

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The 61xx Class were almost identical to the earlier 51xx and later 81xx Class. They did however, have an increased boiler pressure which resulted in a greater tractive effort.

The 61xx locomotives spent their working lives on the Paddington suburban services and were capable of hauling heavy trains at fast speeds due to their increased boiler pressure. In GWR days standard unlined green livery was carried. B.R. applied both lined black and lined green liveries to the class.

Summary Specification



Approx length 44"

- Coal-fired live steam
- 5" gauge
- 2 Outside cylinders
- Piston valves
- Stephenson valve gear
- Mechanical drain cocks
- Mechanical Lubricator
- Silver soldered copper boiler
- Multi-element Superheater
- Pole Reverser
- Boiler feed by cross head pump, injector, hand pump
- Etched brass body with rivet detail
- GW Pattern Double Safety Valves
- Painted and ready-to-run
- Choice of 3 liveries

Approx Dimensions:
• (L) 44" x (W) 9.5" x (H) 13.5"

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Mike Pavie

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Building a 6-inch Foden C Type wagon

Peter begins an occasional series describing the painting, assembly and setting up of a Steam Traction World kit – ideal for those without the skill or equipment to build from scratch.

BY PETER MALIM OBE

I first came across model engineering as a teenager in the form of a 3-inch scale traction engine at a local fete and was fascinated. I determined that at some point I would own one. Work and lack of money – as a junior civil servant – meant that it remained just a dream for many years. Regular visits to steam rallies retained my interest, though did nothing to really improve my knowledge.

In 1991, after several promotions and with my wife also earning we had the money and opportunity to fulfil my ambition. I have basic DIY skills including gas and arc welding, but no experience of lathe work or milling, so I decided it would be sensible to buy a ready-built model and I duly purchased a brand-new 3-inch scale Wallis and Stevens Simplicity roller. I had been building a motor caravan in a Dodge 50 series van and had a suitable trailer for transporting the roller to rallies. All that was needed was a driving trailer which I set about building (**Photo 1**).

With great enthusiasm we set off for our first local rally, having not steamed the model prior. My lack of understanding became clear very quickly as I struggled to fire the roller and when I did get some steam up it was abundantly clear that it was not going to pull the trailer, let alone with one or two people on board.

The full-size Simplicity was designed primarily for export to be cheap to build and operate, with an angled boiler and no separate firebox. This means the grate is semi-elliptical and the front is right up against the tubeplate. I was subsequently put in touch with a fellow model owner with much experience who confirmed that in model form the tubeplate was very susceptible to blocking. I persevered for the rest of the season, but it was clear this was not the model for me.

I sold the Simplicity and in 1993 came across a 3-inch Burrell agricultural engine which had been built – not very well it turned out – but not steamed. I bought this and set about stripping it down and rebuilding it.



PHOTO 1: The start – 3-inch scale Wallis & Stevens Simplicity roller, driving trailer, transport trailer and motor caravan behind.

PHOTO 2: Take 2 – the 3-inch Burrell engine after refurbishment

PHOTO 3: What the model will hopefully look like when it is finished. Photo: Steam Traction World

PHOTO 4: The workshop, with paint booth in the corner. Effort spent on premises makes for more enjoyment in the build.

Photos by the author unless otherwise credited

I had joined the Guildford Model Engineering Society and several members gave me a lot of help with the rebuilding which I completed once the boiler had been given and passed a hydraulic test (**Photo 2**).

Fate then intervened with a further promotion at work which was to take me from suburban Woking to Bristol. My wife gave up work and we bought a run-down Grade 2 listed farmhouse and 12 acres of land in West Somerset which we filled with horses, dogs, cats and poultry. It was clear that there would be no time for model steam so I reluctantly sold the Burrell and put such thoughts to the back of my mind.

Renewed interest

When I retired I had the time to finally finish renovating the farmhouse, which was very near to Hinkley Point nuclear power station. When power supplier EDF announced that it was to build a new power station on site, we fell within a zone where the firm offered to buy the property, so we sold it and moved to a smaller property near Llanfair Caereinion in Powys, Mid Wales. By now we had fewer animals and more time to spare.

The Welshpool & Llanfair Light Railway is just two miles away from my home and I began volunteering there shortly after moving. I qualified



as a fireman after training, and I have worked in the workshop on locomotive renovation so my knowledge of steam engines has dramatically improved. Several of my fellow volunteers are accomplished model engineers, so I felt I now had the knowledge and back-up required to get back into scale model steam.

I still didn't feel competent to build an engine from scratch, so I set about looking at alternatives. I came across Steam Traction World, which offers fully machined traction engine kits in 2, 4 and 6-inch scale.

Having previously had 3-inch models I decided that I was after something a bit more substantial so I looked at the 6-inch models. The firm had recently bought the rights and patterns for the Little Samson agricultural engine – this is relatively small, so at 6-inch scale it is a manageable size. Unfortunately when I was looking there had not been enough pre-sales to start batch production and I was keen to get going on my project, having made the decision to buy.

I have always liked steam lorries and so decided to sign up for STW's well established 6-inch Foden C Type, as this offers a substantial model that is large enough to be easy to drive, but small and light enough at just about a tonne to be towed on a trailer behind a large family car.

STW offers several ways to buy the kits: one payment and kit a month for 30 months; one smaller payment per month with kits delivered every two months for those on a tight budget; or a fast track with all kits delivered either straight away or when stock is available. Being the impatient type, I have opted for the fast track option – in my case kits 1-11 were available three months from order, with kits 12-20 and 21-30 then following at four-monthly intervals.

The finished model will (hopefully!) look like the one in **Photo 3**. As lorries were generally painted in a haulier's colours, there are no recognised Foden colours. This gives the modeller free rein to choose and I am looking at a darker red for the axles, black for the chassis, classic green for the bodywork and a varnished load bed and roof. The model in the photograph has the optional extra load-bed sides and back which I plan to fit to mine.

Preparing for the build

The Foden when complete will be 3.55 metres long, 1.17 wide and 1.36 high – about the size of a small car – so a reasonable space is required to assemble it. This space needs to be easy to heat and of course to keep clean for painting.



The previous owner of our house mended garden machinery for a living and had set up a workshop in the barn behind the house. This has a mezzanine for parts storage in the back half, which is 4.6 metres square. This is just big enough so I have enclosed the area below with an insulated wall and I have insulated the ceiling, installed plenty of LED lighting and power sockets, and painted the whole lot white (**Photo 4**).

The Foden's new home is provided with double doors, salvaged from refurbishment of the house, and has a window for daylight. I have found over this winter that it remains warm and dry enough with just a couple of 750 watt heaters on thermostats.

I have used this area as a general

"Being the impatient type, I have opted for the fast track option – in my case kits 1-11 were available three months from order..."

workshop since we moved and fitted carpet tiles which I bought cheaply at an auction. However these are not suitable for the level of cleanliness required for painting, so I have now installed a laminate floor over the top.

I have benches running either side, leaving the centre area free for assembly. I have set up a paint booth in one corner – this will have extract ventilation using an old welding fume extraction unit.

As I write these words I am still deciding whether to spray or brush paint the model. I have little experience of spray painting so I intend to do some experimenting before deciding. Due to the sheer size of the chassis, axles, body panels and some other parts I expect that I will



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brush paint these and spray the smaller parts. I am going to use Craftmaster Paints, as recommended by the kit suppliers.

Whilst the kits are fully machined

they do need de-burring and hand finishing, so I have invested in a Dremel and a bench grinder/polisher. I already had a wide range of DIY tools and spanners. A key tool will be

6



PHOTO 5:

Kit 1 – the chassis test fitted prior to disassembly for painting. As everything hangs down off the chassis it is easier to assemble it upside down.

PHOTO 6:

Some of the larger kits on the bespoke trailer – this has an electric winch for easy loading.

an angle grinder with flap wheel and rotary wire brush for cleaning edges and removing mill scale.

Getting the kits

Due to the size of the chassis – it runs the full length of the lorry (Photo 5) – it cannot be cost-effectively sent by courier. The remainder of kits 1-11 are also quite large so would be expensive to courier.

In order to transport the model around once completed, I needed a trailer. When I was enquiring about purchasing the model I discovered the owner had a trailer specifically built to carry his personal Foden model which was now surplus to his requirements, so I purchased it from him (Photo 6). I have used this trailer to collect the first kits from the STW works in Daventry, a 2½-hour drive away.

Now I have the kits home, it is time to start the assembly. I have made two wooden trestles to support the chassis during assembly, then once it is on its wheels it will be on the ground so I can move it around.

Kits 1-11 when assembled provide a rolling chassis, kits 12-20 include the boiler, water tanks, smokebox and cylinder, and kits 21-30 are the motion, pumps, gear guards, cab and rear body. Finally the optional kit 31 provides the rear body back panel and drop-down sides.

Let the build commence! In the next article I will describe the painting and assembly to rolling chassis stage. Hopefully this will be completed before the next batch of kits is due... **EIM**

More information

Further details of the Steam Traction World range can be found at www.steamtractionworld.com

Highlights coming next month in...

- New series – a Stirling Single in 5-inch gauge
- Cylinder fabrication for a 3-inch traction engine
- continuing build of useful bending tool
- Hauling heavy goods by steam
- Latest from the clubs and tracks
- ...and much more!

Next issue, July 2022, on sale 16th June

Planned contents as stated but subject to change

THE MAGAZINE FOR MODEL ENGINEERS ENGINEERING in Miniature



Tender Bender

The demands of their latest loco build see EIM's resident innovators Peter and son Matthew come up with a 'universal' bending tool to create almost any radius, or virtually none...

BY PETER & MATTHEW KENINGTON Part 1 of a short series

Regular readers will know that, amongst a range of other projects, we are building a GWR Collett tender in 5-inch gauge, as the first part of the construction of a Manor 4-6-0 locomotive. We are doing this 'from scratch', as opposed to using a kit of some form and have even designed the tender in CAD, so we have some (highly) detailed drawings to work to.

We are also trying to avoid using pre-cast parts wherever possible and have only resorted to two types so far – wheels and axleboxes, as we had these already. Essentially, we want to learn as much as possible from this exercise, building from 'first principles' so far as we can.

We are making good progress, with much of the chassis now complete (at least the parts are made and tested for fit, if mostly not yet assembled). We are therefore turning our attention to the body/tank and hence some more serious, precision, sheet metal bending than we have had to do so far in our model engineering 'career'.

GWR tenders, as most of you will know far better than us, have a slightly tricky structure when it comes to metal bending – they have a radiused flaring and then, immediately, a sharp counter-bend. Some (many?) people form this latter part separately and then rivet and solder it in place, using the vertical strapping which forms a part of the prototype. This struck us as possibly a little weak, from a

"Bending sheet metal requires some form of metal bending tool or jig – our workshop was embarrassingly devoid of such luxuries..."

HEADING:

The finished bending tool, looking smart in its green Hammerite livery

PHOTO 1:

Commercial sheet metal bending tool.

All photos by the authors



structural perspective when made from brass (as ours will be), and led us to think if there was a way of forming this from a single piece of metal.

To add further complexity, the rear corner is a radiused bend and not sharp and needs (ideally) to be formed from the same piece of metal as the side. Then there are the few thousand rivet holes in the whole structure which will weaken the metal, assuming that these are drilled prior to bending... I think it would be fair to say that we were (and still are!) a little apprehensive of this task, having never done anything like it before.

Covering all angles

Bending sheet metal requires some form of metal bending tool or jig – our workshop was embarrassingly devoid of such luxuries, so we started looking around at possible options. Hereford SME has a couple of commercial metal folding jigs – one example of which is shown in **Photo 1**. These are good for forming minimum-radius bends in a sheet of flat metal, but of limited use beyond that, such as for forming radiused bends.

Likewise, rollers are good at forming (generally large) radius bends, but of no use for sharp bends. There are combined tools available, however one which might meet our size needs, the best part of 700mm of bending length, would have cost more than £700 and even then, would not form a small enough bend radius for the flaring, with its rollers. It began to look like a custom-designed solution might be the way forward.

A good idea, with this type of problem, is to discuss it with someone

who has done it before... After all we are far from the first model engineers to ever face such an issue. We had a very fruitful discussion with EIM correspondent and fellow Hereford SME member John Arrowsmith. He not only showed us his bending tool (upon which ours is heavily based), he also brought along the tender upon which it had been used.

Unfortunately, however, this didn't quite provide the whole answer, as the tender, whilst having beautifully flared sides, did not have (or need) the sharp return and vertical upper section that is required on a GWR Collett tender.

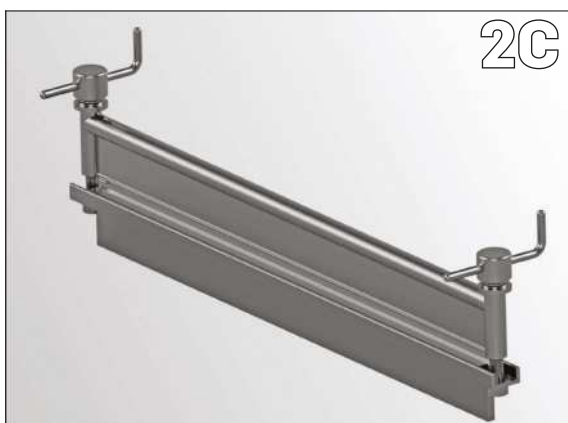
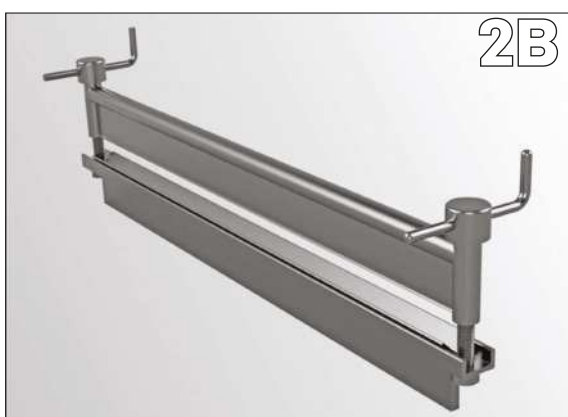
John very generously passed on his bending tool to us and we brought it home, thinking: "problem (largely) solved". It then dawned on us that John's tender was quite small and ours will be somewhat larger – as mentioned we will need to flare a section which is close to 700mm long. John's tool was simply not big enough for this task. It did, however, provide us with some very useful inspiration...

New year, new design

Having come to the conclusion that we would have to go to the effort of designing and building something, we started to think of what we actually needed it to do and what we might like or need to do with it in the future. There is a danger in such thinking, known as the WIBNI effect: "wouldn't it be nice if..." We tried to constrain ourselves to some degree, whilst still making our efforts in building a new tool a little more worthwhile.

Looking at the existing tool we had been given, it was elegant and





The difference between Photo 2A and Photo 2B is that in the latter, the bending blade has been inverted and a rod added to a groove milled into what is now the lower side of the blade. In this case, the rod is of a square cross-section, in order to form a conventional 90-degree bend, but other rods can be used, as will be discussed (along with methods to hold this user-changeable rod in place while the bender is in use).

Finally, Photo 2C replaces the angle-iron pieces in the base of the bender with a solid-steel anvil, featuring a narrow V-groove at its centre. This enables sharp/tight 90-degree bends to be made using the same square cross-section rod introduced above.

So, what are the features and capabilities of the design? Without trying to look too much like a sales brochure, they are:

- 1) Capable of creating a 'flared' bend of approximately 12.5mm bend-radius, at a precise location (with the aid of some guide pieces, which will be discussed later)
- 2) Capable of creating a radiused or flared bend of any size from perhaps 2mm up to 8mm bend radius (and potentially more, with care) by means

3) Capable of creating 'minimum' bend-radius bends, for a given thickness of metal (such as 1.5mm radius bends with 1.5mm thick material). In practice, even smaller bend radii are possible, as will be discussed in due course

4) Capable of creating 'sharp', precisely-located, 90-degree bends (again, by means of a suitable rod, in conjunction with an anvil)

5) Flexibility to replace the base formers in the bending tool with custom-designed parts for specific applications – some options for these will be discussed later

6) Easy to judge (and achieve) precisely-located bends. This is slightly more difficult to achieve in my very limited experience with the 'fold-over' type of bending tool shown in Photo 1

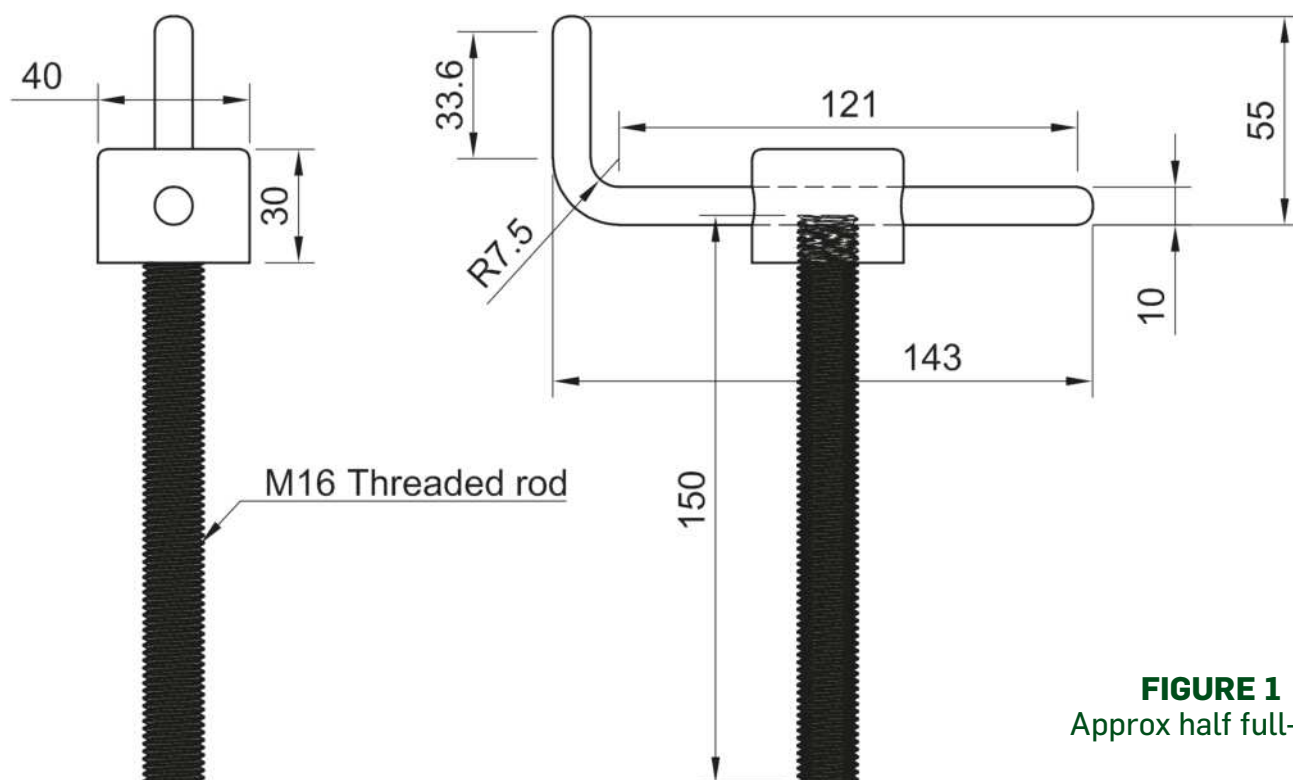
7) Locating indicators to aid alignment

8) Capable of bending at least 1.5mm thick brass sheet and 1mm thick mild-steel or stainless steel sheet (and probably more, in both cases)

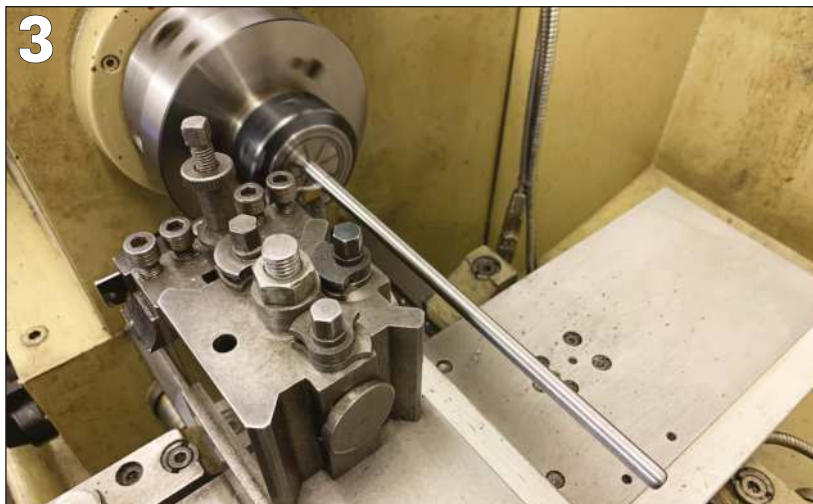
9) Simple and not too expensive to construct for a 'beginner', especially if you have a decent stock of 'scrap' metal lying around (perhaps not many beginners will have such a luxury...).

The main aim, overall, was to create a tool that was flexible (but not in a mechanical sense, of course!) and could be adapted to as-yet-unknown future bending requirements, so far as practicable. Only time will tell how successful we have been in achieving this latter goal.

The tool is a relatively simple item to construct, although some welding is required. Some milling operations could be omitted, if a slightly 'cruder'



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tool is acceptable and these will be highlighted at the relevant point in the description. It is therefore an ideal 'beginners' project, especially if you wish to hone your welding skills on a not-too-critical design.

Handle on things

A good place to start is with the handles and attached screw-threads. The required dimensions are provided in **Figure 1**, although most of these can be taken as a guide and are not critical. In particular, the dimensions of the handle-rod itself (notably its length) are as much a matter of taste and material availability as anything else, above an obvious minimum.

The handle rod is first rounded on one end and then parted to the required length (**Photo 3**). We used silver steel for the handle as it is both more rust-resistant than mild steel and also pre-ground to a precise diameter of 10mm. This allowed us to create a precision fit for this part into the handle boss, using a reamer (as will be discussed later, in relation to Photo 12). Two identical parts are required (**Photo 4**), as there are two handles. Note that the parted-off end of each should also be rounded, as shown in the photo.

We are fortunate in having a rod/bar bending tool and we made full use

of this in bending the handle rods (**Photo 5**). We bent both at the same time to ensure that they were identical, although this was only for cosmetic reasons.

If you don't have a bending tool, clamping each rod in a vice, together with a suitable diameter of former, will do a similar job. A length of thick pipe can serve as a bending lever or some blows with a heavy lump hammer are another option (having protected the rods from impact damage with a brass or aluminium shroud, say).

The completed handles look quite smart (**Photo 6**) – we're still new enough to model engineering to take pleasure in such aesthetic niceties!

Moving on now, to the handle bosses: again, two are needed and both are identical. These were made from mild-steel rod, as we had some of a suitable diameter left over from a previous project. The outer diameter is not critical and was simply turned down and faced to 'clean-up' the surface finish (**Photo 7**).

The centre-hole was pre-existing (from the aforementioned earlier project); the use of a collet chuck for both the prior project and this one ensured that this hole was reproducibly in the same, central, location, without additional setting



PHOTO 2: Bending/flaring tool configured for (a) flaring, (b) bending and (c) sharp-bending.

FIGURE 1: Tool handle and screw-thread dimensions.

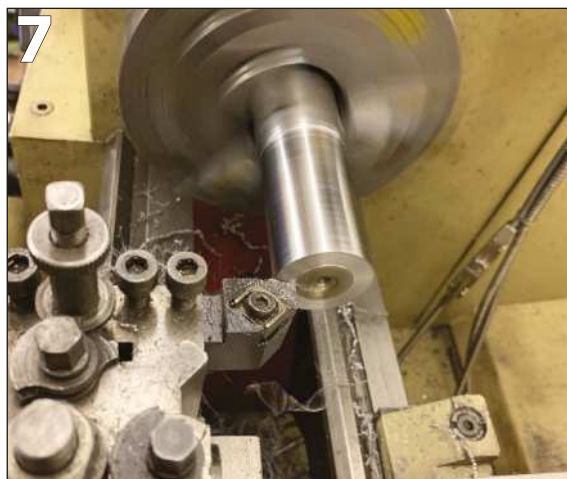
PHOTO 3: Rounding and parting-off a length of rod for one of the handles.

PHOTO 4: Completed rods for handles, ready for bending.

PHOTO 5: Bending the handles – doing both together ensures they are identical.

PHOTO 6: The completed handles with an engineer's square, for reference.

PHOTO 7: Facing the handle-boss.





up, such as using a tailstock centre or chuck-plus-drill bit to locate the centre whilst tightening the chuck. Again, this is not a critical part in terms of centring, so we didn't need to go overboard in our setup.

The central hole was drilled to the required depth and diameter and then tapped to M16 x 2 (Photo 8 – note that we used a tailstock centre to hold the tap when starting it off). For the avoidance of doubt, the chuck key, shown inserted into the chuck in the top-left of Photo 8 is being used to hold (and sometimes turn) the chuck, whilst tapping the hole, and not for loosening the chuck! An M16 tap takes quite a bit of turning, so a little extra leverage is useful.

Once the thread had been tapped, we checked its quality and depth with a length of threaded rod (Photo 9) – we didn't have an M16 bolt available for this purpose. The two nuts at the end of the rod are tightened against each other and the whole was then used in a manner akin to that of the head of a bolt.

We used stainless steel M16-threaded rod, for convenience, although a length of plain rod could be used and an M16 thread cut on it using the lathe. We used the same piece of threaded rod both to test the thread in the handle boss and, ultimately (once halved in length), in the final product.

Once the thread is satisfactory, the handle-boss can be parted off to the required length and the threaded rod can be cut to length and inserted.

With the threaded rod inserted (tightly!), the whole structure can be returned to the lathe, with the threaded part being gripped in the chuck (Photo 10). The parted-off end of the handle-boss can then be faced and the upper edge (or outer edge, as oriented in the lathe) can then be rounded and the whole sanded/polished as desired. It is much easier to do so at this stage than once the handle itself has been inserted.

Loctite can be added when finally screwing in the lengths of threaded rod, if desired, but shouldn't be needed. This is for two reasons: firstly the thread will naturally tighten as a bend is formed and secondly the handle will be used to 'lock' the rod in place, as can be discerned from Figure 1.

The complete boss-and-rod structure can then be transferred to the milling machine or bench-drill and a 9.5mm hole drilled in the centre of the round face, starting with a centre-drill, of course, as shown in Photo 11. This hole can then be reamed to 10mm (Photo 12).

Finally, a tack-weld or two can be used to permanently affix the handle in position – TIG welding is the most convenient for this (Photo 13). If you don't have TIG-welding facilities, then

PHOTO 8: Cutting an internal thread with M16 tap.

PHOTO 9: Screwing in a length of M16 threaded rod to check thread in handle-boss – locked-together nuts act as a bolt-head.

PHOTO 10: Once parted-off, threaded rod used to hold handle-boss in a chuck for facing and chamfering.

PHOTO 11: Centre-drilling hole in handle boss, to take the handle.

PHOTO 12: Reaming hole to precisely fit the ground silver-steel handle

PHOTO 13: Handle TIG-welded in place.

PHOTO 14: Thrust-bearing and washer in position.

FIGURE 2: Bending blade dimensions. View of flat part of blade included, with sectioned close-up (A), showing locating V slot for various diameters and varieties of bending former.

a small hole can be drilled and tapped into the centre of the handle-boss from above, such that it penetrates the handle. A countersunk machine-screw can then be inserted to hold the handle in place. M5 or M6 should be suitable screw sizes, as this screw will be under very little force, when the tool is in use.

The handles are now complete and we can move on to the bending blade.

Thrust-bearing & washer

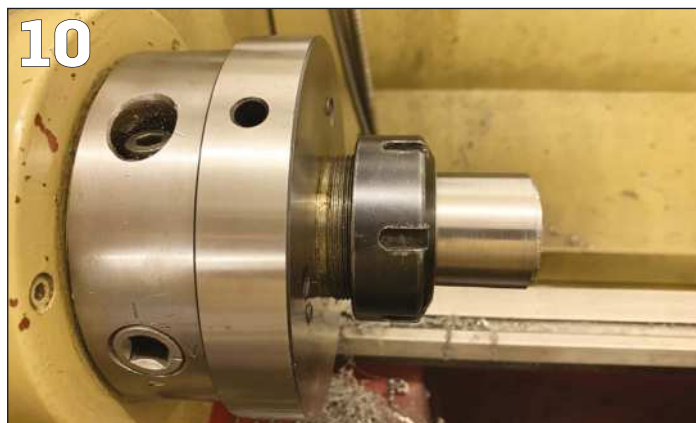
A thrust-bearing and a (thick!) support washer are used to provide the handle-boss with a low-friction, well-supported platform upon which to rotate (Photo 14). These need to be detachable (at least to a degree), to allow the blade to be inverted in some variants of the tool's application.

Commercial parts were used for both of these, as they are inexpensive (a few pounds) and widely available. The thrust-bearing is of type 51103, with dimensions 17mm (hole) x 30mm (diameter) x 9mm (thickness). The washer is of a 'thick' type, with dimensions 16mm (hole) x 39.5mm (diameter) x 5.7mm (thickness) and is made from stainless steel. Alternatively, a couple of standard M16 Form F or Form G washers could be used.

The upper part of the thrust bearing was Loctited to the underside of the handle boss, being careful to centre this, since the bearing's hole diameter is 1mm greater than that of the M16 thread. Likewise, the bearing's lower part can be Loctited to the washer. The strength of these bonds is not especially critical, since they are primarily for convenience when assembling the tool and they may come apart occasionally in use.

Blunt Instrument

When is a blade not a blade? When it's blunt...? The blade we are concerned with here is that which is forced into the sheet metal by tuning the handles we have just made. The blade is designed to be two-sided: the lower side, as configured in the drawing shown in Figure 2, is made from a



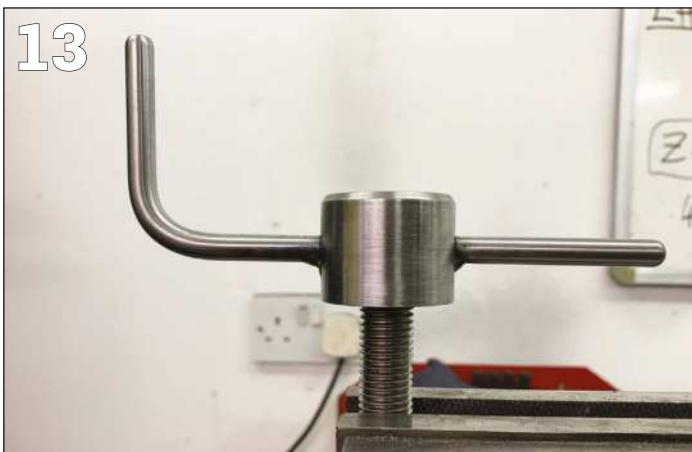
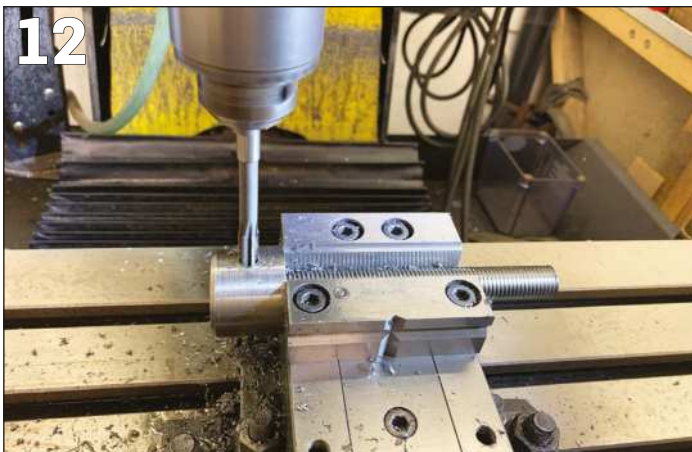


FIGURE 2
Approx quarter full-size

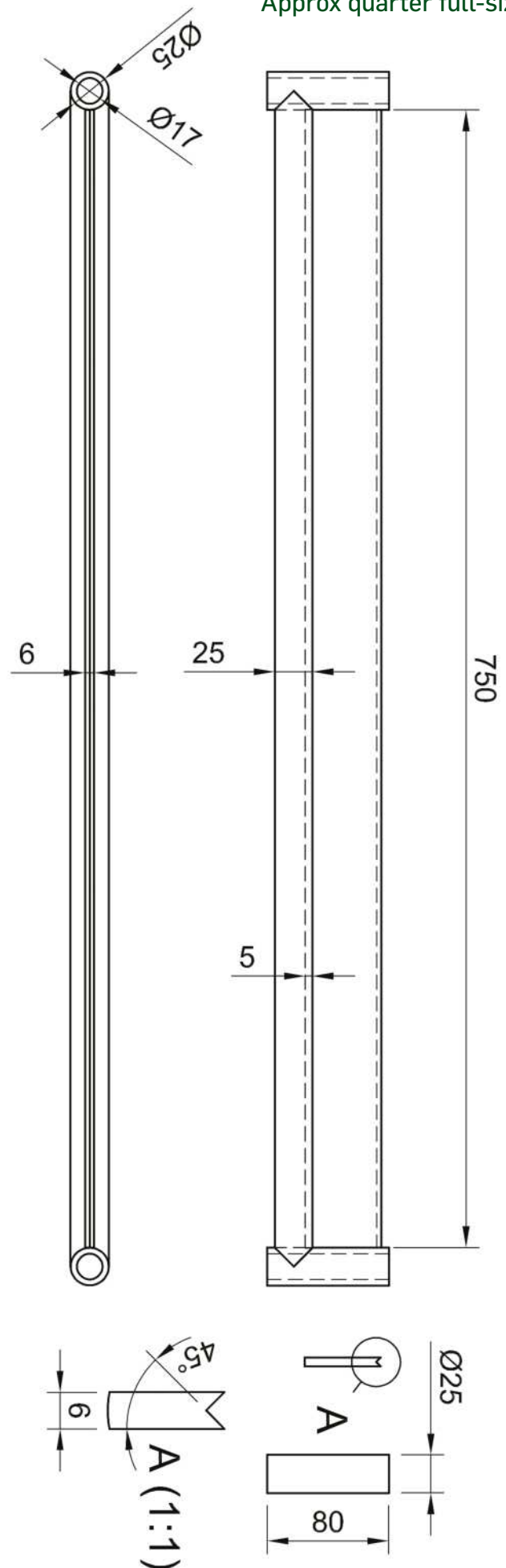




PHOTO 15: Milling 6mm slot in the 25mm rod. Copper foil hanging out of back of left-hand vice (which we didn't bother to trim!) being used as 'shim' to ensure that part is aligned between jaws of the two vices.



PHOTO 16: This took a long time...

PHOTO 17: Finished at last!

PHOTO 18: The bracing bar fits beautifully in the slot. The machining of the semi-circular arc was detailed in an earlier article (EIM April 2022).



the main 'blade', the rod and the guide tubes. Note that the rod should be cut to a length which is 25mm longer than the flat part of the blade, in other words 775mm, to allow for the arcs which need to be cut into each end.

Slow and steady

The next step is then to mill the 6mm slot into the top of the rod (Photo 15). This is a slow process, but, as in many things, slow and steady wins the race. As can be seen in the photo, we used two vices on the bed of the milling machine to support and clamp the rod. The left-hand vice is a low-precision drill type and this needed supporting at an appropriate height to (approximately) match that of the machine vice on the right; we used some 123-blocks for this purpose. Note that it is not necessary in this relatively low-precision application for the beds of both vices to be at exactly the same heights.

The machine vice was used to set the height and ensure the bar was horizontal (checked with an inclinometer at the further extremes of the rod) and the drill vice was only used to clamp the rod, to prevent excessive vibration when cutting. The rod is thick enough to prevent excessive 'droop' and the precision of the depth of cut low enough that this somewhat crude arrangement was adequate. One day we plan to have a set of matching machine vices for this type of application, but Christmas is now long past...

The left-hand vice needs to be aligned to the right-hand ('reference') vice. We achieved this by making use of the rigidity of the rod, tightening the vice onto the rod, prior to tightening the vice onto the bed of the mill. Again, crude, but effective and sufficient for the application – although it wouldn't have worked with thinner/less rigid rods.

We did need to re-set the rod a couple of times, as the rod was longer than the bed-travel on our mill. This re-setting process would have been necessary even if we had a more capable mill, as excessive rod stick-out

from the safety of the clamping forces of the vices leads to vibration (and even resonance) which certainly reduces precision and can even lead to a tool breakage.

Leaving the tool at full depth in the slot (at a suitable position along the emerging cut) helps to ensure that the part remains aligned when re-adjusting it in the vices and also helps with keeping the part roughly level during the process. I will say again, this is not a precision cut! It just needs to be 'good enough'.

Photo 16 shows the progress of the cut after our first 're-set' of the part and Photo 17 shows the end of the process. Make sure that you start the cut with a few things to mull over, perhaps what new tooling is needed for the workshop or where to go on holiday – as all will be well and truly 'mulled' by the end!

Due to the re-setting needed for the workpiece (and the time this took), we elected to mill to the full depth of the cut from the start, rather than taking quicker, but shallower, cuts. This worked well but, as noted above, was slow...

Once the slot has been milled, the flat plate, forming the bulk of the 'blade' should be a nice press-fit into the slot (Photo 18), although don't do this just yet.

Note that we did contemplate using a slitting saw to cut the groove. We didn't do so for two reasons – we have only one slitting saw and almost no experience of using it (!) and we weren't convinced that we would be able to maintain the precisely-horizontal setting of the slot/rod when re-setting the piece (there being no obvious reference point for this, other than the saw blade itself).

We would also have had to deal with the parts of the rod held in the vices, in our re-setting processes. If you are more confident (and experienced) with slitting saws than we are, it might be the way to go. **EIM**

■ Peter and Matthew will continue the construction of their bending tool in next month's EIM.

The Woes of Yeo – Woe Again (and other stuff)...

Last month our Fairbourne Railway engineer described how he had fixed the Welsh coast line's oddly-steaming Lynton & Barnstaple loco – or so he thought...

BY HARRY BILLMORE

I concluded last month's column with our 6-inch scale Lynton & Barnstaple 2-6-2T 'Yeo' (Photo 1) back in traffic after its steaming issues were sorted out – this did not last long... A couple of days later the locomotive came limping back into the station wheezing horrendously on one half of the stroke of the left-hand side cylinder. This immediately told me the gasket between the valve face and the cylinder bore had failed.

On this engine there is a split between the cylinder bore casting and the valve face – this split runs right through the middle of where the exhaust passage goes through the frames. This requires a gasket that seals between the inlet passageways and the exhaust passageways with the nearest compressing fixture about three inches away at the centre with full valve-chest pressure on one side and exhaust on the other.

Unfortunately the builder of the loco had then compounded this less than ideal situation by making the land on the underside valve face less than half an inch wide, despite there being plenty of room to increase it with minimal extra machining. You can see in Photo 2 the copper gasket that is the width of the land, and the gap that has been caused by it being blown up the chimney.

I unfortunately do not have many pictures of me fixing this as the loco was required for the two engines in steam service over the Easter holidays, so I was working flat out on overtime to sort it. But as you will see later, I was able to take a load of photos of the same fix but on the other side of the engine – I will explain the whole procedure with the photos of that side!

Axle angst

With Yeo back in traffic and our Welsh Highland Railway style 'Russell' out as the other engine, I finally had a chance to get back to making the new axles for our Darjeeling 0-4-0 'Sherpa'. I had got as far as cutting the old axles in half and cutting the bearing journal, so I could get the wheels into our vertical press slightly more easily, before putting one



PHOTO 1: 'Yeo' in traffic – a rare sight...

PHOTO 2: Note missing section of copper gasket between exhaust and inlet port, also flat machined section before inlet port goes down to the bore.

PHOTO 3: Boring out axles of 'Sherpa' to allow the press to do its job.

PHOTO 4: Final diameter reached, note dark patch on hole edge where Harry went slightly too far and exposed original bore of wheel before retreating to finish bore.

of the wheels on the press and trying to press the axle out.

Unfortunately the 25 ton press maxed out and did nothing to move the axle in the wheel – therefore I needed to machine the axle out from the wheel centre to the point where





the press would move it. This was a slightly interesting operation as the bearing journal was still the old inner races of the original roller bearings. These are extremely hard and duly put up quite a fight. Carbide tooling,

patience and a lot of coolant won out in the end and I could drill up to the largest drill we have before trying the press again.

Still no movement, so back to the lathe and the boring bar was pressed



PHOTO 5: Axle being pressed out of the wheel.

PHOTO 6: Axle stub shows just how thin material was needed to make press work.

PHOTO 7: Axle length marked once other end faced off.

PHOTO 8: Light punch marks centre point of axle.

PHOTO 9: Tool tip carefully aligned with the scribed mark.

PHOTO 10: Manually turning chuck to create a score mark around the axle.

PHOTO 11: Bed stop set to stop any accidental over travel.

PHOTO 12: Part-machined axle end – small amount of material still needs removal for correct final length.

Photos and diagrams by the author

into action (**Photo 3-4**), you can see by the photos how thin I needed to make the bit of axle remaining in the wheel to allow the press to work (**Photo 5-6**).

Once all of the wheels were removed from the old axles, I could measure them up to create the drawings to work from for the new axles. When measuring older bores like this, I like to take measurements at the top of the bore, then 90 degrees to a previous measurement, then at a couple of spots further down the bore to make sure the bore is both round and not tapered.

Measure for measure

I then take a couple of measurements, taking my time with them to ensure accuracy, and write them on the wheel so I know exactly the size of the bore. I then transfer this to my drawing adding three thou (a thou per inch plus a thou as a good rule of thumb for wheels and axles of this size) so when I am working from the drawing I have an exact number. I do this by scribbling notes all over my machining paper copy of the drawings so you won't see the exact details in the drawing here!

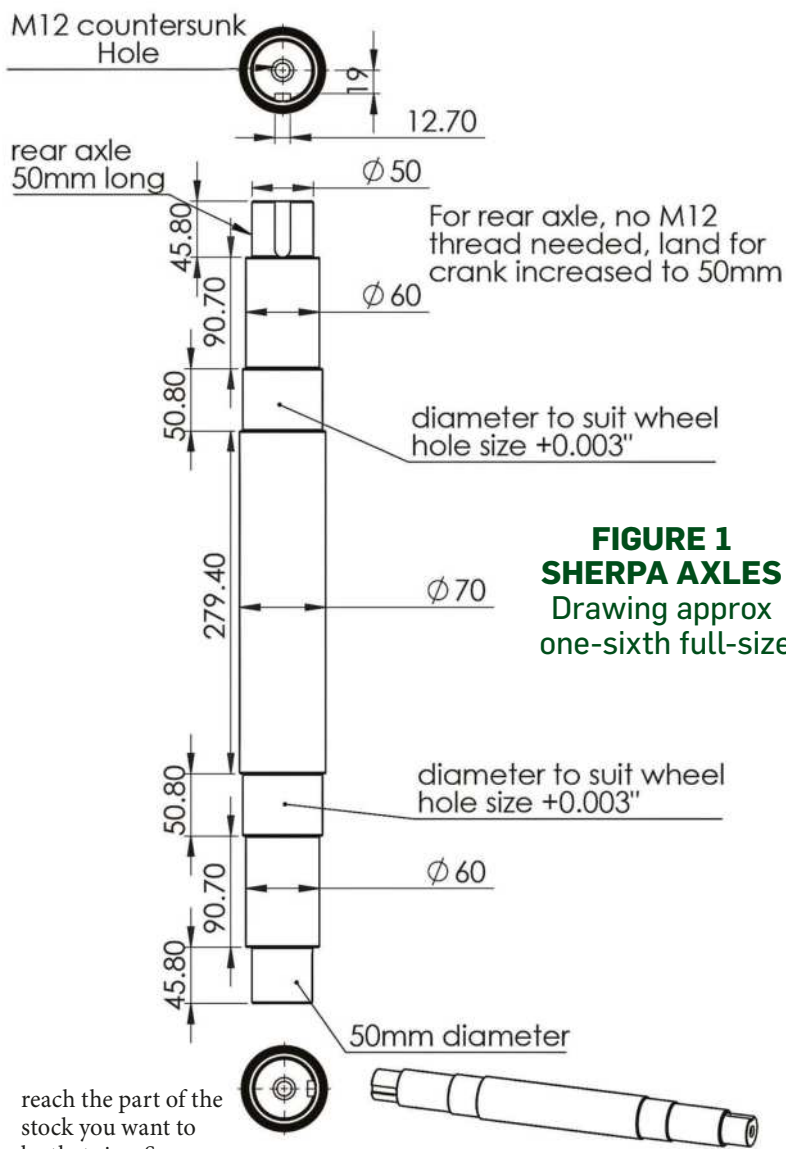
Then comes the actual laying out and machining. I started by facing off the stock and putting a large centre in the end for support later in the process. Then using a set of sacrificial verniers that I have ground to a scribe point (cheap sets of non-digital non-dial verniers can be very useful if you do not have a trammel or other making equipment) I marked the finished length of the axle (**Photo 7**) and the centre point before checking with my decent and very accurate set of vernier calipers that I had marked these positions correctly.

I then accurately and lightly put a centre punch mark on the exact centreline of the axle (**Photo 8**) – this is very useful later on for checking and double checking lengths and provides for a good datum for ensuring aspects such as the back-to-back and journal positions are correct.

Mounting the axle blank in the lathe, I then set the tool to the length mark (**Photo 9**) before gently rotating the chuck to score a line all the way around the material (**Photo 10**). Once this reference line was completed, the tool was withdrawn and backed off a few thou before a bed stop was positioned to stop the carriage over travelling (**Photo 11**). The diameter could then be machined down to the correct size, before removing the stop and machining up to the mark as can be seen in the photos (**Photo 12**).

The handy thing with a stepped shaft such as on these axles, is that you have plenty of material to set the tool to the correct diameter before you





reach the part of the stock you want to be that size. So you can take lots of short passes, adjusting the tool until it is just perfect in the steel that will be eventually machined away to get to the journal size, for example, before taking the final cut. This process is then repeated for the journal size and the crank size before final polishing before turning the axle

around and doing it all again at the other end (**Photos 13-18**).

It was just as I was about to turn the axle around that one of our hard-working volunteers wandered in and asked me to take a look at his current project. This was supposed to

FIGURE 1
SHERPA AXLES
Drawing approx
one-sixth full-size

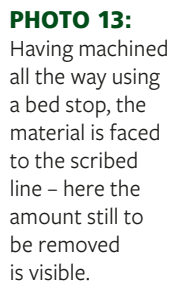


PHOTO 14:
After view with
the axle to
length.

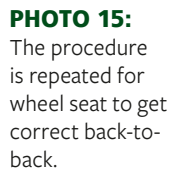


PHOTO 16: With amount still to be taken off at right-hand side time can be taken setting up final cut on the material to be machined away.

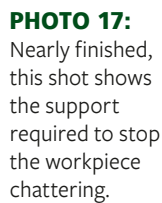


PHOTO 18: Final polish of bearing journal surface to make it as smooth as possible and exactly to size.



19



21



22



20



PHOTO 19: A quick paint job turned into major re-framing and new panels. Rotten framing visible here, especially by Peter's hand on the top rail.

PHOTO 20: With roof removed and the end framing out for replacement of the top rail and painting the frames under the timber.

PHOTO 21: Cause of a little cursing, one of Yeo's steam chest studs lifting with the steam chest.

PHOTO 22: Freshly machined valve face having its stud holes enlarged. Also visible the notch that needed removal to clear the frame stretcher bolt.

PHOTO 23: New gasket in place, note much wider leg where the valve face meets the bore casting.

PHOTO 24: Inlet stub hole with valve on the right.

23



we took the decision to do a full re-fit and a large amount of re-framing and re-skinning (**Photo 20**).

Interestingly one of the 4 x 2-inch roof timbers had started to rot, despite being well protected by the glassfibre roof and well ventilated. The seaside environment does take its toll on everything unfortunately!

Out of breath

Just as I had made a decent start on the second axle for Sherpa, I heard Yeo pull up with its train, once again wheezing horrendously. My immediate thought was that the gasket I had fitted to the left-hand side had failed and I would need to do it again. This was not the case however, it turned out to be the right-hand side this time, again the front joint between exhaust and inlet ports.

This was somewhat more of a pain as I had not had the right-hand side apart in any meaningful way, which meant that I would have to cut the main inlet stub and make a new one, as well as tap the steam chest all the way through and a few other little tweaks as well as fixing any issue I found along the way.

Thankfully it was the last day of the two engines in steam service so Yeo struggled through the rest of the day, using far more water than it should with a large amount of the steam going straight up the chimney!

Next day I started the stripdown process, which unfortunately includes stripping off all of the valve gear back to the expansion link. This is the only way to get the valve rod tail support off the valve rod, which is then the only way of removing the top link that joins the two halves of the split combination lever together, which needs to come off because you cannot withdraw the valve rod through that top link far enough to get it out of the steam chest...

So once I had finished cursing at the valve gear (held together by a mix of metric and imperial fasteners, taper pins and hope) I could then set about removing the steam chest cover, which necessitated taking off the snifting valves and the feed for the steam chest pressure gauge.

With all that out of the way I unscrewed the valve rod from the buckle and removed the valve and valve buckle before stuffing the steam ports with rag to prevent any unwanted bits falling into them.

Once all that was off I could then get a hacksaw in behind the steam chest to cut the inlet stub – the reason for having to do this is that as built, it was assembled from the valve chests inwards with the main steam pipe from the boiler being fitted last. This is fine if you have the time or inclination

to remove another few feet of pipework and renew several gaskets and the seal in the bottom of the smokebox...

My solution is to have an inlet stub that screws from the inside of the valve chest, through the hole in the frames and then screws into the bsp (British Standard Pipe thread) union on the bottom of the main steam pipe T. Once again I failed to take any pictures of these modifications, but I hope my description makes sense!

With the inlet stub cut I could lift the valve chest off, unfortunately one of the studs came with it (**Photo 21**). These pass through the valve chest cover, the valve chest and the valve face before screwing into the cylinder bore casting, and a stud lifting with the valve chest meant it had pulled the thread out of the cylinder casting, which is extremely difficult to access due to the overhanging tanks.

Inner space

After a little more cursing, I removed all of the cap-head bolts that hold three quarters of the valve face to the cylinder bore casting and the two bolts that go through the exhaust flange and frame from the inside of the frame. I then tried to lift the valve face from the bore casting – it moved up the studs an inch before hitting one of the frame stretcher bolts.

Further more inventive cursing ensued, before all the studs were unscrewed from the bore casting and the valve face lifted off to reveal the damaged gasket. After removing that as well and giving everything a good clean-up I discovered why the stud had pulled out...

Whoever had done this job before me had used a lot of silicone to try and seal everything, unfortunately this had just squeezed into the bottom of the stud holes so when the studs were fitted they only went in three threads' worth before bottoming out on a pile of silicone. This was fortunate for me



PHOTO 25:

With valve traveling full amount, inlet stub hole totally covered—about a $\frac{1}{16}$ gap between buckle and the valve chest side.

PHOTO 26:

Machining a section of the buckle away.

PHOTO 27:

Buckle back in after machining, showing space for steam to pass and the lack of clearance before.

PHOTO 28:

Picture taken at same angle as before – much more of the inlet hole visible.

as I only had to clean a load of silicone out of the stud holes rather than try and drill and tap out a hole to fit a custom-made stud.

While doing this work I also noted that the studs had different threads on each end, a Whitworth thread on the bottom, then a shoulder and an M10 thread at the top. This meant that the valve face would not be able to pass over the section that was M10.

While I had the valve face off I re-machined the valve face and drilled out the stud holes to allow it to drop over the studs (**Photo 22**). I also cut a notch out of one corner to allow it to pass the frame stretcher bolt. With a fresh gasket made (**Photo 23**) with a significantly wider section where it had blown out before (wider than just the land) and a load of steam seal I refitted the studs, gasket and re-machined valve face.

I then tapped the inlet stub hole all the way through the valve chest casting before making a new gasket and fitting this too. A new inlet stub followed with a 1-inch BSP thread at either end and the centre section machined down to the diameter of the bottom of the threads – this makes it



far easier to fit. I screwed this through the valve chest from the inside and then through into the union on the main steam pipe.

Once all that was done I could then refit the valve and buckle, however as can be seen in the pictures I noticed it effectively seals off the inlet to the valve chest for a reasonable amount of the time (**Photo 24-25**). This did explain the weird readings one would get from the steam chest pressure gauge, with some of the stroke being at a lower pressure than the rest of the time.

My solution to this was to machine a section of the buckle away to allow steam to flow relatively uninterrupted into the steam chest (**Photo 26**). This is not a perfect solution, but without a redesigned valve and buckle arrangement it will have to do (**Photo 27-28**).

I then reassembled the rest of the motion, shimming up the valve rod guide as the new gasket material is slightly thicker than the old one.

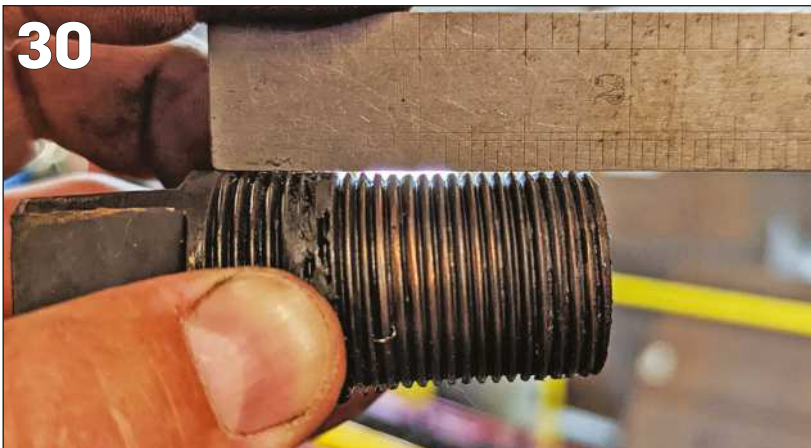
Since Yeo was nearly at the end of our 28-day washout cycle I decided I might as well wash it out before returning the loco to service. So out



29



30



came the washout plugs, the fusible and the blowdown valve and the pressure washer was employed heavily to make sure I had got all of the silt and bits of scale out of the boiler.

By a neck

Before the washout plugs go back into the boiler they are checked to ensure they are not necking – this occurs when a section of the thread starts to degrade due to being tightened down in the matching tapered bush in the boiler. If this happens, it can feel like the plug goes up tight, but without full thread engagement this can lead to plug failure.

The way to check for this is to put a straight edge against the threads and ensure the tips are touching for the full length of the threads (Photo 29) – if not it's time for a new plug. The photos show one of Yeo's plugs and one of Russell's which I have replaced due to it suffering from necking (Photo 30).

In the smokebox refitting the front tubeplate washout plug, I spent time staring at the blastpipe while fiddling with spanners and the plug. Once I had finished with the plug I stuck my finger down the blastpipe with an idea of what I would find – sure enough there was a restrictor that had been placed in the end of the exhaust piping to produce a sharper blast and thus draw the fire a bit better.

Unfortunately this restrictor had been put in with a perfectly flat bottom (Photo 31) and a parallel bore (Photo 32). The flat bottom edge acts like a sea wall to the steam trying to make it up the chimney and reflects some of this steam back down the exhaust piping, increasing back pressure and generally making things worse. The parallel bore is okay, but it does not take advantage of any of the expanding properties of steam.

I removed the top section of the exhaust, which handily had a long threaded portion. This would allow me to raise the blast nozzle 1½ inches towards the petticoat pipe which should improve matters considerably.

I then proceeded to put a large drill up the bottom of the nozzle section – this will give a 60-degree cone on the bottom rather than a 90-degree flat edge which should help quite a lot (Photo 33).

I then turned the nozzle around and using a small boring bar, turned a 5-degree taper into the end of it so the top edge would act like the end of a trumpet, accelerating the steam as it leaves the diverging cone (Photo 34). This should again increase the draw on the fire and help with the steaming.

With that done, I could refill the boiler, light the fire and test the engine to make sure all was okay before returning it to traffic Thankfully it all

“Further inventive cursing ensued, before the studs were unscrewed....”

PHOTO 29:

Checking a washout plug for necking, this one good to go again.

PHOTO 30:

Some threads on this plug do not touch a straight edge, so plug has been replaced.

PHOTO 31:

Exhaust reducer showing the flat bottom facing the steam.

PHOTO 32:

The other end, showing the parallel bore.

PHOTO 33:

Bottom end of the nozzle with its new taper made by means of a drill.

PHOTO 34:

Machining the diverging cone into the top end of the nozzle – this should accelerate the expanding steam and increase vacuum in the smokebox.

31



32



33



worked very well, though as I write this I only finished the test runs a few hours ago, so you will have to wait until next month to find out if Yeo makes it to its next washout without a major failure... **EIM**

■ The Fairbourne Railway Gala is on 28th-30th May featuring visiting 12¼ and 15-inch gauge engines. Details are at www.fairburnerrailway.co.uk

34



GL5 at ESSMEE

Happy to be out and about again, our roving reporter John has been enjoying some 5-inch gauge mainline in miniature in Somerset...

BY JOHN ARROWSMITH

The annual 'GL5 Rally' of the Ground Level 5" Gauge Mainline Association took place over the 22nd to 24th May, on the East Somerset Society of Model and Experimental Engineers (ESSMEE) track at Bath & Western Showground near Shepton Mallet, with a good attendance by GL5 members and the promise of a good weekend.

I arrived on Saturday morning and the line was already in full operational mode, the steaming bays busy and plenty of rolling stock in the top yard. There was a plentiful supply of tea and cake available in the ESSMEE clubhouse and a good atmosphere prevailing throughout the club.

It was also good to catch up with many GL5 members who I hadn't seen for some time and as usual they were all ready for the day's operations.

One of the first locomotives on the track was the splendid Britannia 4-6-2 owned by Norman Norton who told me that it was a rebuilt Modelworks engine, and I have to say that he had made a first-class job of it. This was only the loco's second run since the work was completed. It moved smoothly with very little regulator needed and Norman explained how he had achieved this with his modifications to the regulator.

Medal winner

In the steaming bays the first engine I looked at was an excellent example of an LNER B1 4-6-0. Built in 1968 it won a Silver medal at the 1970 Model Engineer exhibition, and it is now owned by James Puzey, Chairman of the Wimbourne club in Dorset (Photo 2). It was soon on the track hauling a rake of Pullman coaches and the combination was a fine sight – the B1 handled this large load with ease.

What was good to see at this rally was the number of younger members involved in all this and by younger members, I don't mean young people between 10 and 16 although there were quite a number of them as well, but people in their '20s and '30s who were all getting stuck in and enjoying themselves with a variety of engines and rolling stock.

In fact one driver told me that he thought that this was the way that running days would be held in future, simply because the younger people



PHOTO 1: The superb Britannia owned by Norman Norton backs into the steaming bay after its turn on the main line.



PHOTO 2: James Puzey's excellent B1 is ready to go out on the main line.

PHOTO 3: Graham Porcas from Oxford heads back towards the main station with his goods train.





PHOTO 4: The 4F of John Foxton and Hughes Crab emerge from the tunnel with a stopping passenger train.

PHOTO 5: 5-year-old Connor with his dad's GWR Pannier checks his water level while shunting in the top yard.

PHOTO 6: The main yard turntable has a clever track arrangement that enables both 7¼-inch and 5-inch gauge track to always be in line.

PHOTO 7: The van train arrives in the bottom yard.

PHOTO 8: An excellent Class 50 in the sidings waiting for its train.

PHOTO 9: Matt Fowles backs his 14XX and refrigerated van train into the siding to pick up his guards van.

PHOTO 10: This 10-year-old was enjoying himself shunting in the bottom yard.

PHOTO 11: A rare 47XX 2-8-0 locomotive waits with a Dynamometer car in the top yard.



found it more interesting than hauling passengers round and round a track, without all the current regulations needed to operate public running. Food for thought there I think!

One of the main operations at GL5 rallies is of course the making up of trains which go out onto the main line and drive a few circuits before returning to either the main station or one of the goods yards. At ESSMEE there are two yards and a good main station which connects to the large steaming bay area. This in turn leads to interesting loco movements as the access to the main yard is along part of the main line – the signalman has a busy time providing suitable paths for both the mainline train operations and access to the shunting yards.

Unlike the Gilling rallies where all train movements are controlled from the two signal boxes, here the main box controls the station and steaming areas plus the main line, but the sidings are individually controlled with a separate signalling system.

Complex shunting

It sounds more complicated than it is but it all works well and provides the drivers with lots of opportunities for different driving conditions. The two yards are completely separate from the main line and operations can continue between the two without affecting any main-line trains.

On the main line there is a road crossing which is used for access within the Bath & West Showground, again this is well set out and seems to work very well. Said main line is about half a mile in length and follows a small river which it crosses twice, also curving round one end of a lake before returning to the main station.

A curved tunnel of good length provides a different experience and





PHOTO 12: The 4F has plenty of smoke as it is prepared for its work shift in the busy steaming bays.



PHOTO 13: The double header rounds the lake curve to start the long pull back to the station.

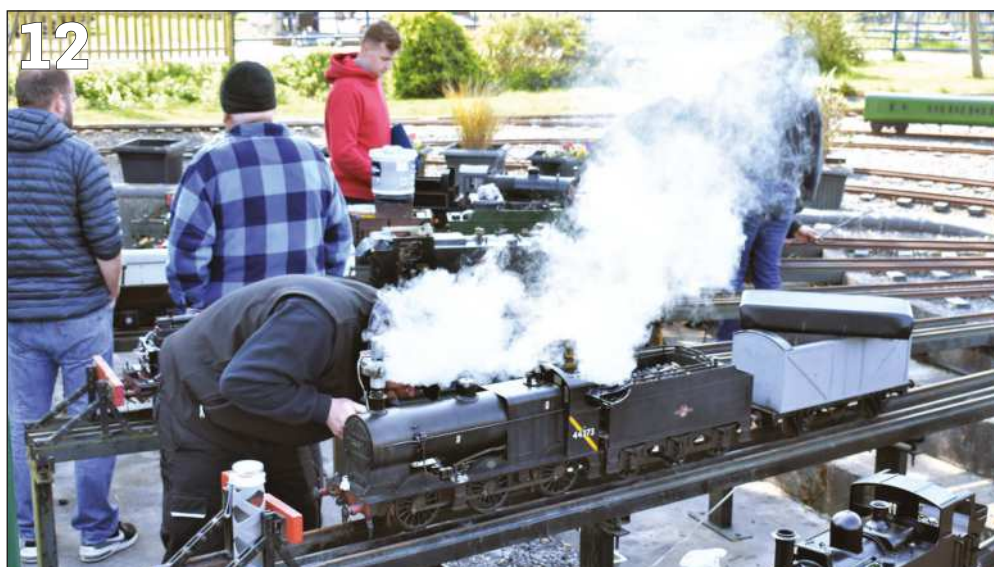
Photos by the author

the entry portal is like an old-style mine entrance, while the exit is a very well-made example in the local Bath stone and really looks the part. I understand that there are plans to extend the railway in the area by the lake so it will be interesting to see what these developments may bring and how the line will look in future.

The ESSMEE is a progressive club with an excellent workshop and members facilities, the carriage storage area has some interesting features and both the main track access points have hydraulic lifting tables to assist with the loading and unloading of locomotives and stock.

On my previous visit the new club loco, a 7¼-inch gauge Black 5 4-6-0, was waiting for the wheels to be finished and fitted. They are now in the frames and progress looks good.

Finally, I would like to thank the ESSMEE members for their hospitality and David Hale in particular for all the information he provided, it was an excellent weekend which I hope can be repeated in the future. **EIM**



A 3-inch scale slate wagon for 7¼-inch gauge

Harry and a friend design and build a ubiquitous piece of narrow gauge rolling stock – and choose an interesting but challenging prototype to base their model on...

BY HARRY BILLMORE

A friend of mine from the Wakefield SMEE and I had for some time been throwing around the idea of making a slate wagon to go along with his 3-inch scale 7¼-gauge quarry Hunslet and Kerr Stuart Wren 0-4-0STs, the intention being that the wagon would require as little machining as possible. During the first lockdown I finally had the spare time to really sit down and think about how to do it.

Of course we chose one of the more complex wagons to build, a Penrhyn Quarry cut-slate wagon built by de Winton & Co of Caernarfon in around 1879, and latterly modified in the quarry's works at Coed-y-Parc. The reason for choosing this particular wagon was that I like the builder and its products, my friend liked the look of the particular wagon and there is rather a nice drawing of it in the book *Narrow Gauge Railways in North Caernarvonshire – Volume 2 the Penrhyn Quarry Railways* by James I. C. Boyd. Both of us had this title on our bookshelves so we could compare notes readily.

There are a few interesting challenges with this wagon, the axleboxes being a particularly complex area, while there is also an interesting shape to the basic fabrication of the body. As a result my friend expected a few flat laser-cut parts to emerge from my drawing board and then to need to spend a long time marking out and drilling angle iron for the top edges and chassis components.

Drill shy

I on the other hand am significantly lazier in the drilling department and as the originals were built from hand-turned wrought iron, the sharp edges of modern angle iron would have looked off to me on a scale wagon. This then led me down a process of designing a wagon that looked like a model built exactly like the prototype, but making use of modern production methods to a bit of an extreme.

The way I chose to do this was to create the side slats of the wagon



complete with the top angle out of a single piece of steel, with a bend in to create the angle along the top. This also stretched down to form the

chassis sides (Photos 1-2). The ends were formed in a similar way, these incorporating the buffer beams.

To make assembly as easy as

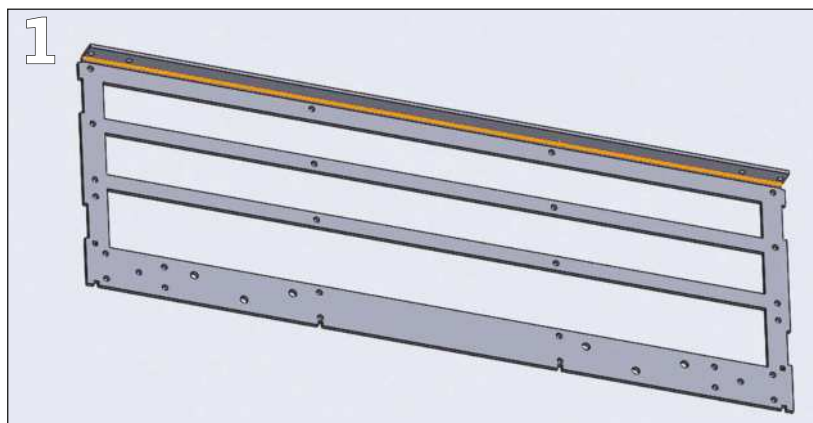
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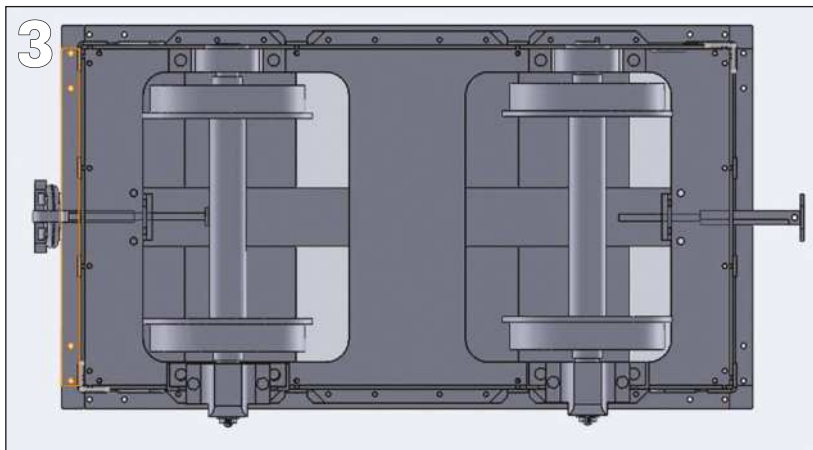
The finished wagon, posed with an equally attractive 7¼-inch gauge Kerr Stuart Wren.

PHOTO 1-2:

Two views of the wagon sides in CAD, showing how the top folds over to form the angle.

Photos and drawings by the author





possible, I put tabs and slots onto the corners so alignment became as easy as possible. These would then be seam welded behind where the corner strapping sits, before these are welded together. However, the chassis top and bottom first needs to be put into place – these are again tab-and-slot fitted to the ends and sides before being welded in with the welds, tabs and slots hidden behind the strapping. These ensure the wagon is square and provide the mounting points for the axleboxes and the planked floor (Photos 3-4).

The corner straps are again pieces of bent laser-cut plate with all the rivet holes already put in, –this is one of the

huge time savers over marking out and drilling angle and strip steel. The vertical slats are simple flat laser-cut pieces that are riveted onto the larger panels, as are the reinforcing straps on the corners of the top bent angle (Photo 5).

Once the main body and chassis are all welded together and the straps and corner pieces riveted on to make the body look the part, the wheelsets and axle bearings are fitted.

The wheels come from Little Western (www.littlewestern.com) as complete wheelsets and I chose to use them with a basic plumber block available from any bearing shop. These were fitted with a laser-cut

PHOTO 3:

Underside view showing cutouts in bottom part of chassis and couplings, the one at right is a link and pin, the one at left is prototypical.

PHOTO 4:

See-through side reveals construction of chassis with the two plates forming top and bottom sections of the chassis.

PHOTO 5:

Complete design showing pillow blocks, bent components in place, floor panels and top section of the chassis.

PHOTO 6:

First test print of axlebox cover, not perfect and delaminating in places, very much at limit of capability of Harry's printer.

PHOTO 7A-B:

Two views of axlebox cover put over pillow block bearing to check for size and fit.

spacer to get the ride height of the wagon correct.

The more complex part of the axleboxes was the covers – on this wagon these are very distinctive and are a complex shape which on our wagon also needed to cover the plumber blocks, as these are not particularly good looking.

Printed boxes

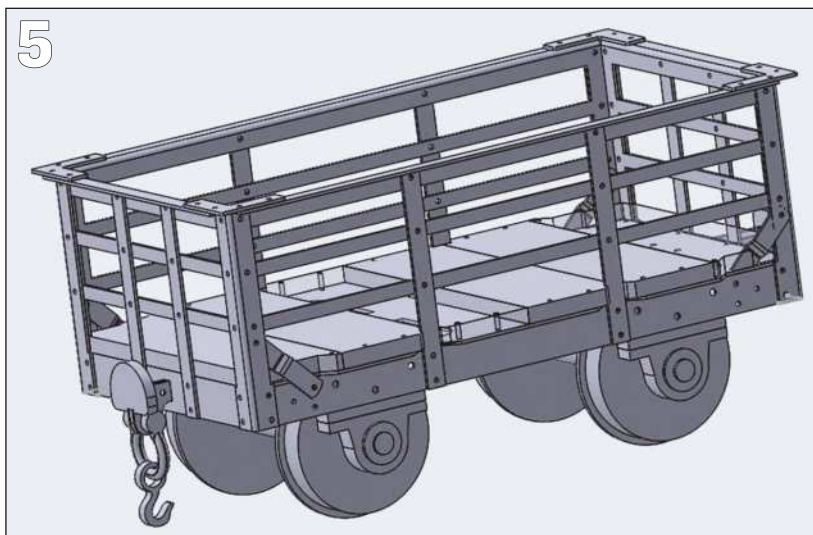
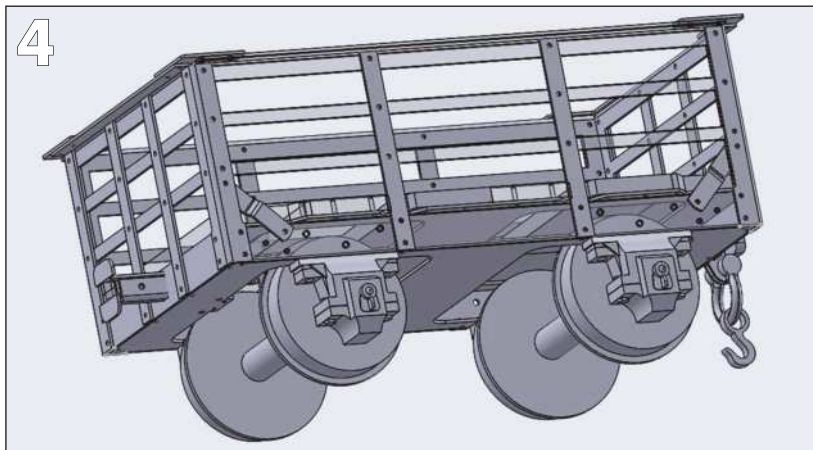
I decided to 3D print the axlebox covers as an experiment, to see how well the resin lasted and because it was the easiest way to create the multiple curves and small details required. The resin printed covers would then be glued onto the plumber-block spacer using epoxy to keep them on (Photos 6-8).

This has proven only partially successful – the big downside is that the resin is too brittle to survive repeated knocks, so the next lot I make will probably be an investment, cast in aluminium from the resin masters to allow for more knocks along with improved fixing to the plumber-block spacers.

I then turned my thoughts to the couplings. We decided that prototypical couplings would be nice on this first wagon so I set about drawing up the buffing face and shank. I then spent a load of time online looking for a suitably sized shackle with as small a width across where the shackle bolt screws in as possible – this then allowed me to laser-cut a hook which then simply slipped onto the shackle and looks pretty good with a bit of filing

The finished item, visible in the heading picture, is not quite as nice as I would have liked as the hole to go over the shackle is still a little large, but it is a pretty good representation of the prototype.

My friend then suggested making the coupling a sprung item... After a bit of thought and several false starts a reasonably simple approach



UP 90° R 2

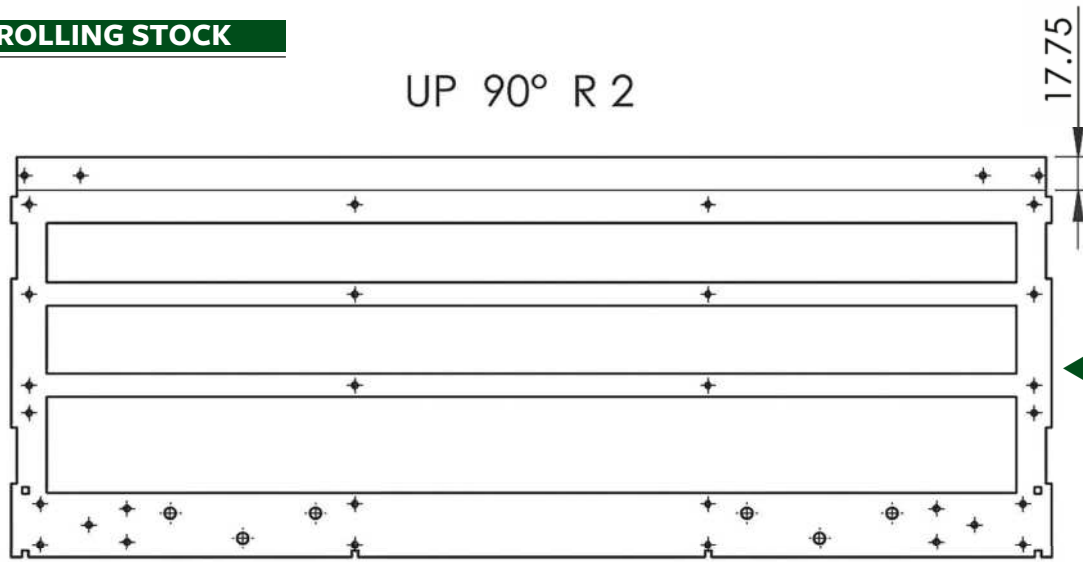


FIGURE 1
WAGON SIDES
(2 off)
Drawing approx
quarter-size

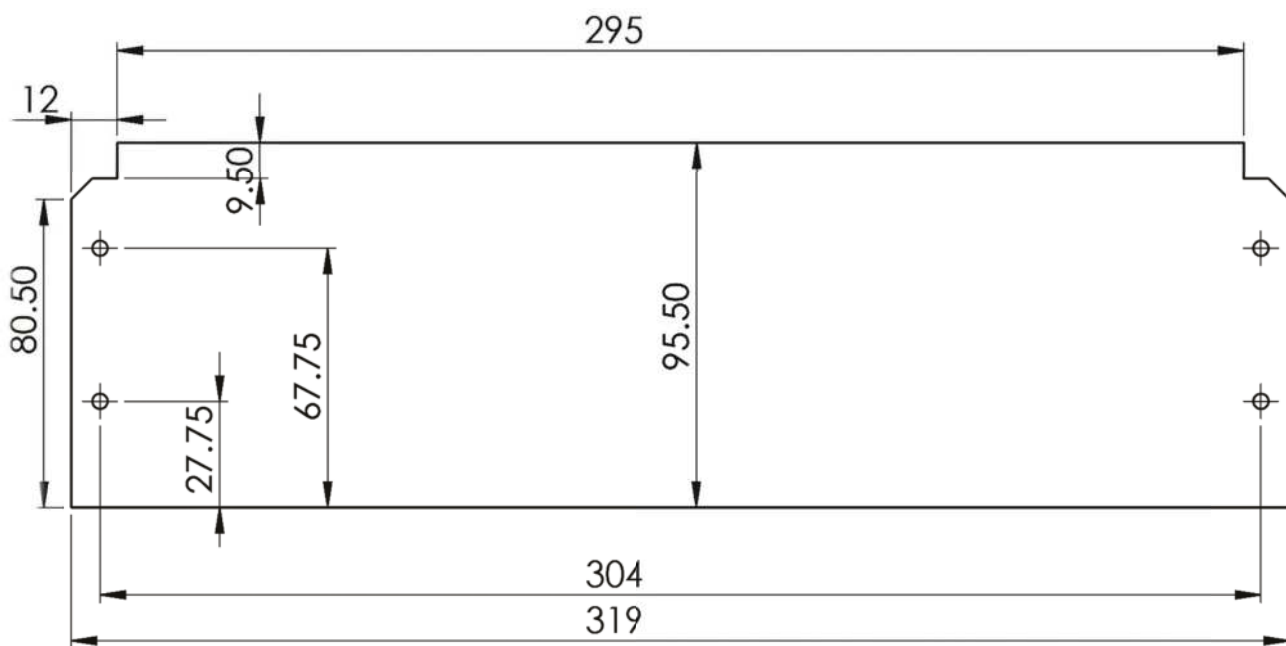


FIGURE 2
CENTRE PLANK
(4 off)

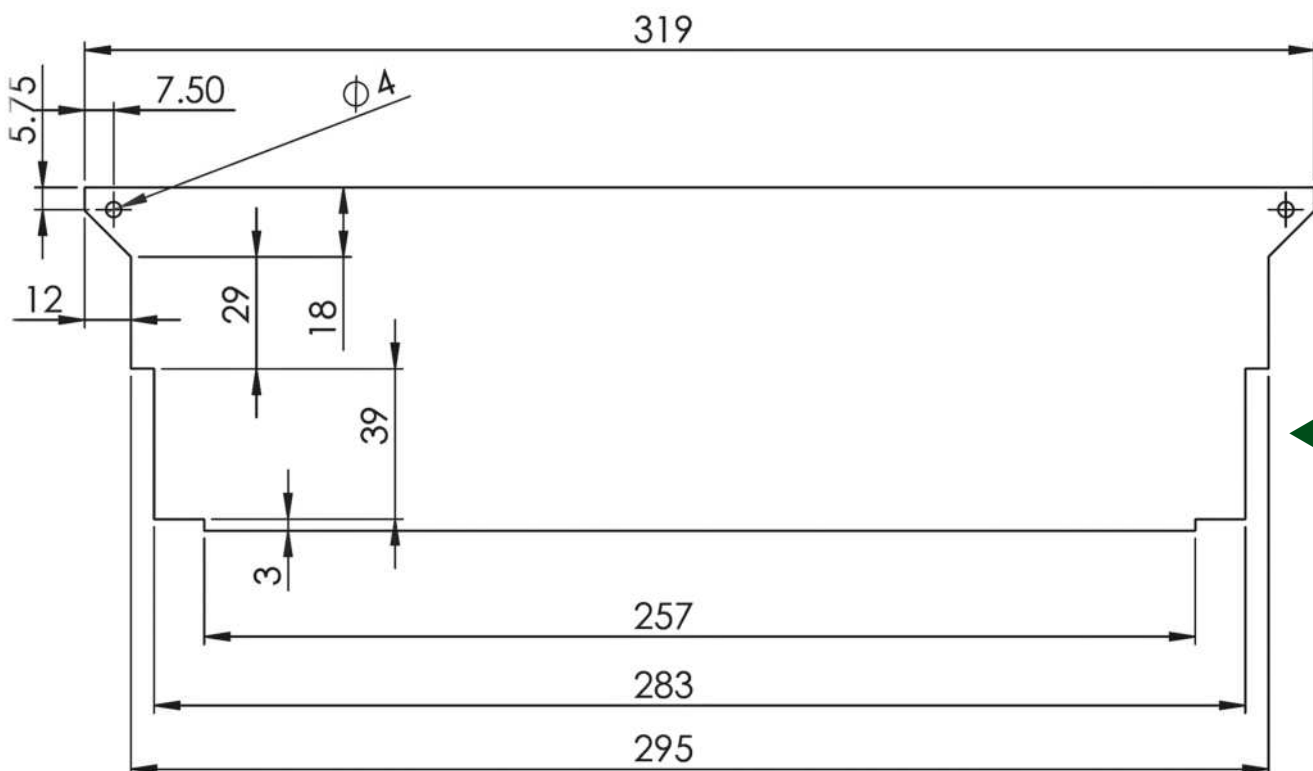


FIGURE 4
END PLANK
(2 off)

DRAWINGS REPRODUCED APPROX
HALF FULL-SIZE UNLESS STATED

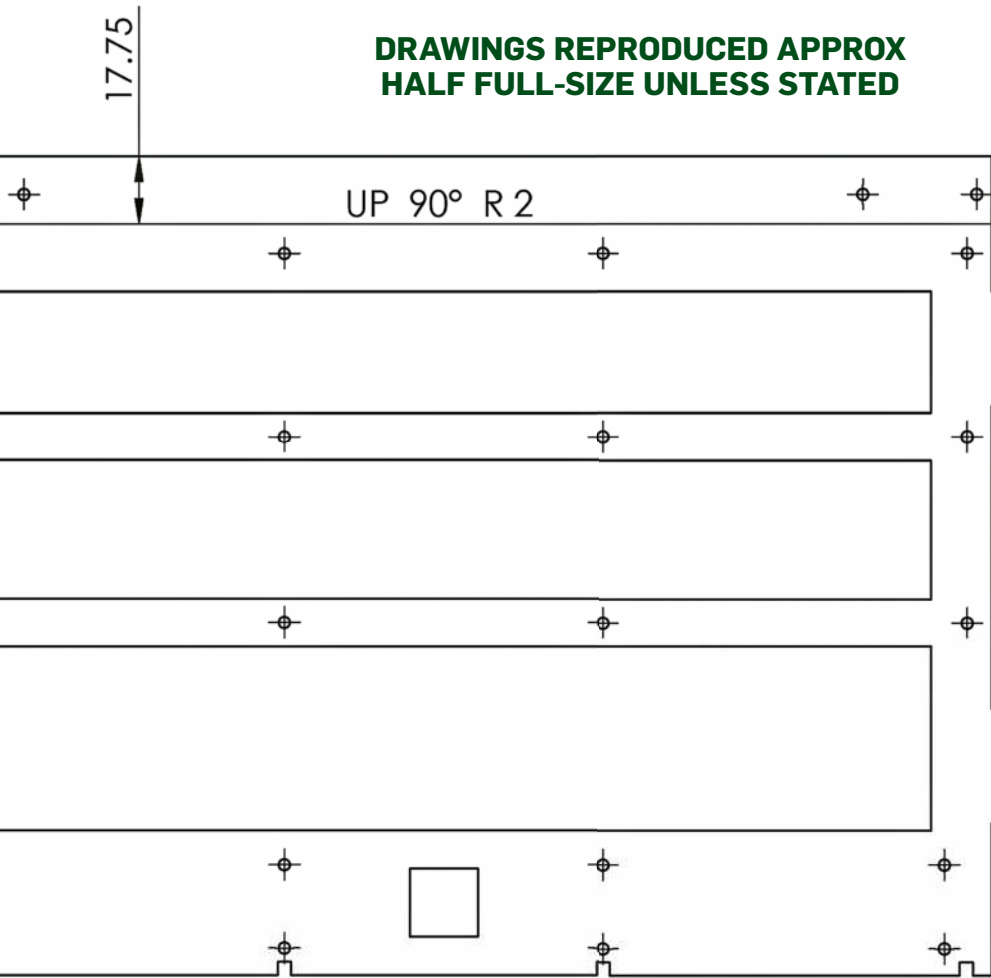


FIGURE 2
WAGON ENDS
(2 off)

3
ANK

FIGURE 5
CORNER STRAP
(4 off)

Drawing approx full-size

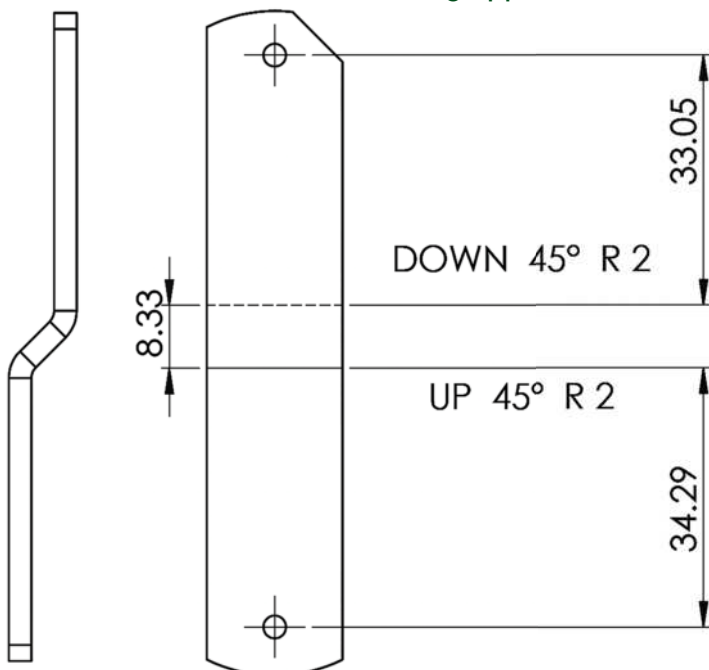


FIGURE 6
CORNER ANGLE
(2 off)

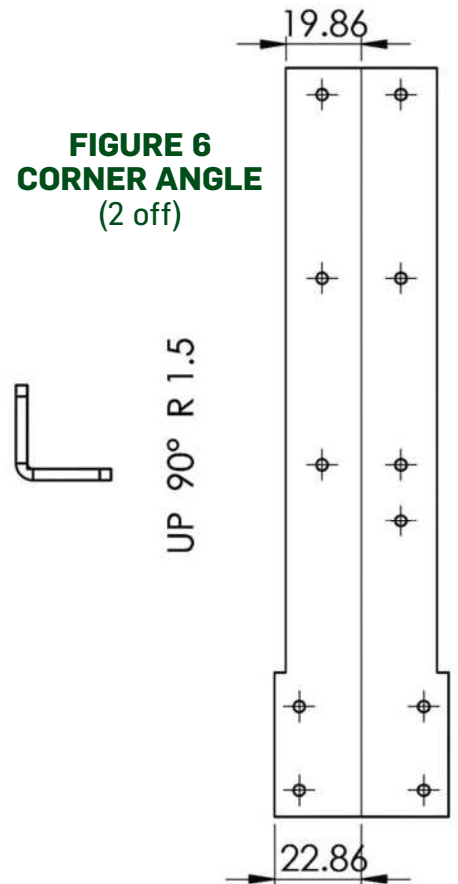
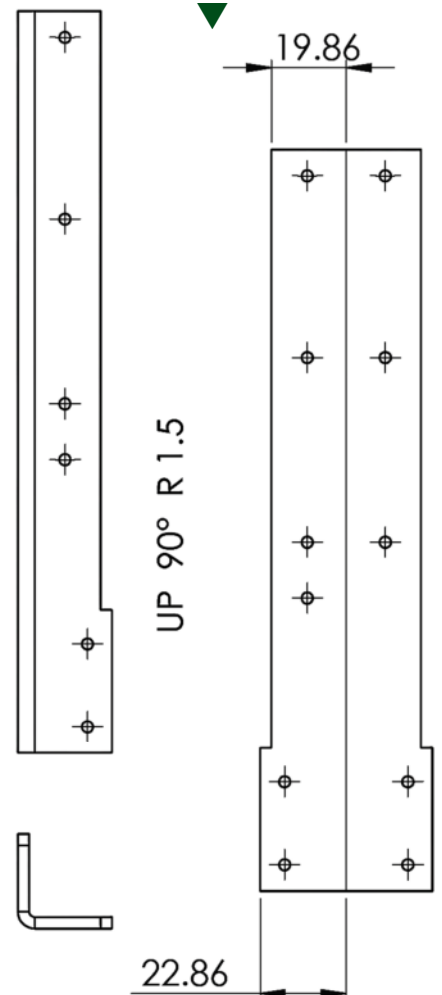
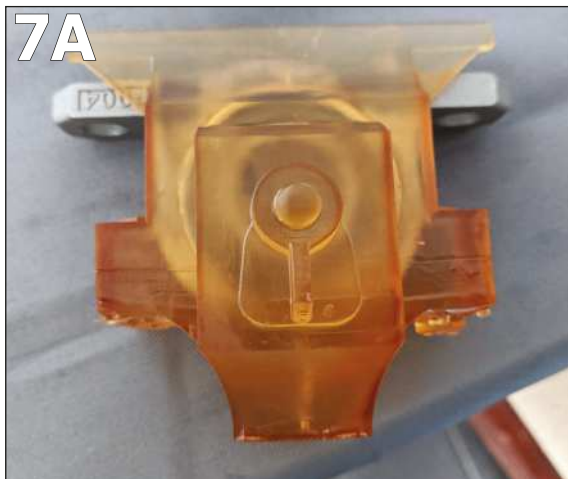


FIGURE 7
CORNER ANGLE 2
(2 off)



7A

7B

8

9


appeared. A headstock plate was fitted in tabs and slots in the top and bottom chassis sections, a little way behind the buffer beams. This distance is far enough so a die spring could fit with space to spare between it and the buffer beam.

The coupling shank was extended so that it passed through this plate and extended another die spring length and a bit, before having a hole put in the end. The coupling shank is also stepped so that the die spring that is compressed when the buffer head is pushed towards the wagon is compressed between the step on the shank and the headstock plate.

Then when the coupling is pulled, the other die spring will be compressed by a bolt through the securing hole in the end of the shank and the headstock plate.

Saw point

Once all the metalwork had been designed the flat patterns were sent off to Model Engineers Laser (www.modelengineerslaser.co.uk) for cutting and I prepared the drawings for the floor planks. We had floated the idea of having these cut out for us, but in the end my friend decided he would cut them himself.

Once the steel parts arrived (Photo 9) he took them to a local fabrication shop and they bent them for him to the bending drawings I

PHOTO 8:

Axlebox covers printed and ready for fitting.

PHOTO 9:

Parts after bending, plus 3D printed axlebox covers and off the shelf parts.

PHOTO 10:

Looking the part with suitable motive power.

supplied. After that it was the relatively simple matter of clamping it all together, welding it up and then riveting the detail pieces on and suddenly we had a wagon! (Photo 10).

Well it took a little longer than that, but with a bit of paint and

finishing it has turned out pretty well, both of us being happy with the result. I have since passed the whole design on to Ed at Model Engineers Laser, so hopefully if anyone else would like one, this will be available from the firm at some point. **EIM**


10

Making a cylinder passage drilling jig

Certain types of cylinder internal passages are not so simple to create in the workshop – Alex describes another useful jig designed to smooth the process.

BY ALEX ELLIN

When constructing locomotive cylinders, I normally mark the position of the passages on the side of the cylinder block and then use that to line it up in the drill vice, very much as has been described by LBSC and everyone since.

Whilst this routine works relatively well for inside cylinders or for outside cylinders with outside valves, it is not so easy for locomotives employing outside cylinders with inside valves. Neither Averill cylinders with round port faces (as fitted to the LBSC 2½-inch 4-4-2 design 'Ayesha') or the more common rectangular port faces such as on the ubiquitous 'Rob Roy' tank engine have flat bolting faces on which to mark things out.

One-hour job

I have recently been machining a set of Averill cylinders for a 2½-inch gauge 'Southern Maid' and, having mulled over the problem for an hour or so, had a lightbulb moment and came up with the jig described here – it took me about an hour to make.

Whilst I made my original jig (Photo 1) to suit any 2½-inch locomotive cylinder block, I have re-schemed it and re-dimensioned it here so that it will cater for any cylinder block for 3½-inch engines and below.

Manufacture of the jig is simplicity itself – it consists of just three components, shown in Photo 2, held together with three 4BA bolts.

The Jig Backplate consists of a 2-inch length of 3-inch x ¼-inch mild steel as shown in Figure 1. If you were only interested in making 2½-inch gauge locos, I would reduce the width from 3 to 2 inches as per my original.

The 1-inch diameter hole in the centre of the backplate is to provide clearance for the circular port-face on 2½-inch gauge Averill type cylinders, some of which can stand an appreciable distance from the bolting flange. This hole allows the cylinder to be supported by the bolting flange, giving increased stability. If you are not planning to make any such cylinders, this hole could be omitted.

Make sure that this backplate is properly square as this will ensure that in use, the jig sits squarely in the machine vice. The 1⅜-inch dimension on the position of the 4BA tapped hole on the edge may need adjusting to suit the size of your machine vice – the reason for this should hopefully become clear when you see how the jig is used.

The Jig Foot, as shown in Figure 2, is a 1-inch length of the same material. The two 4BA threaded holes are to allow the foot to be bolted to the bottom of the backplate to form an 'L'.



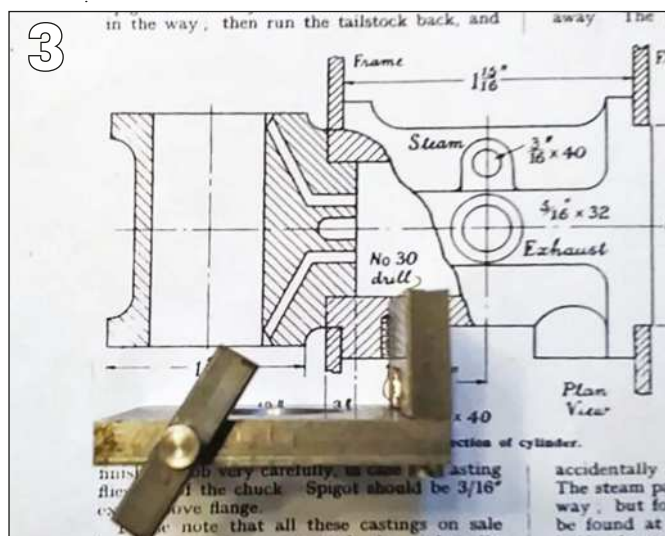
"Having mulled over the problem for an hour or so, I had a lightbulb moment..."

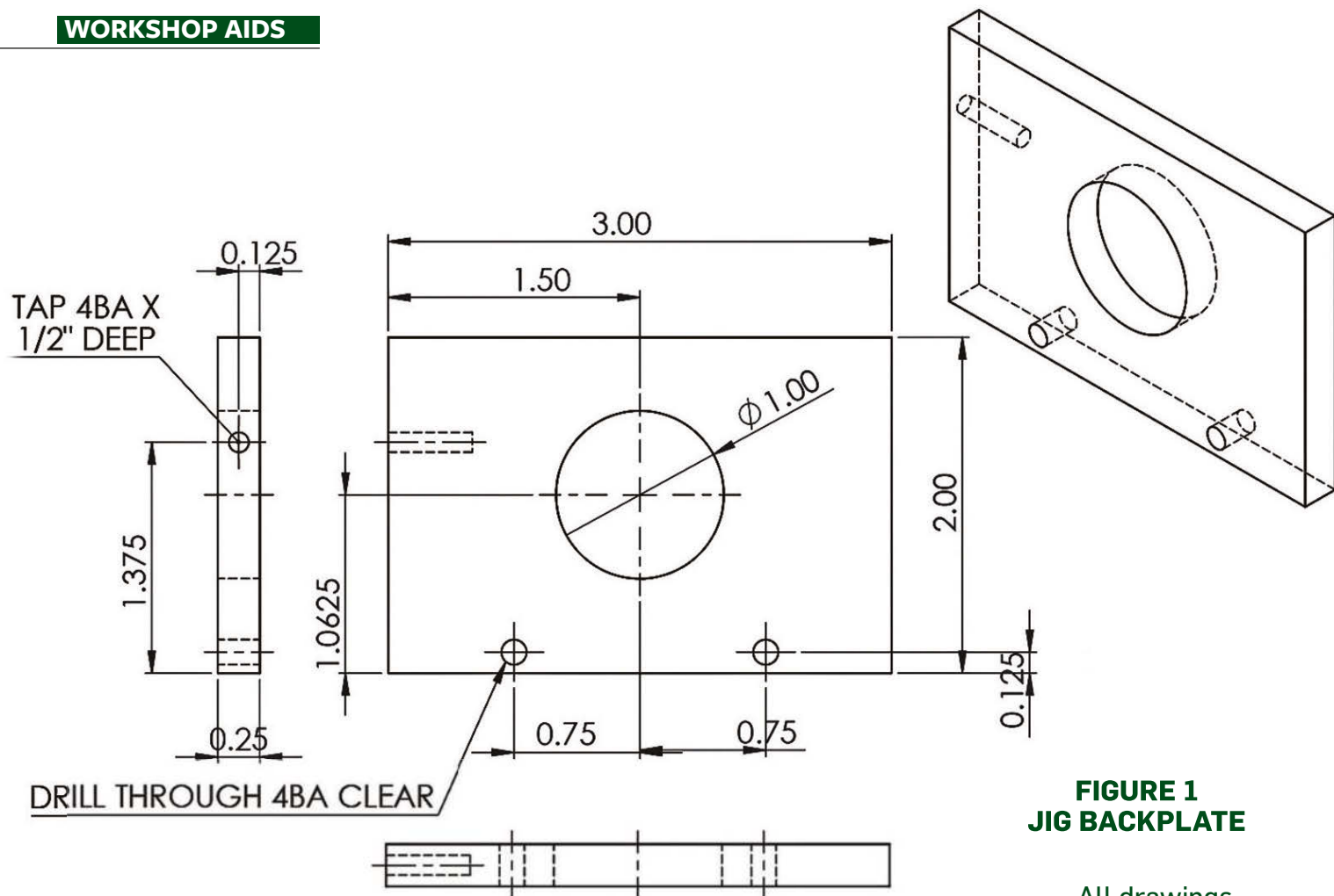
PHOTO 1: The completed cylinder passage drilling jig.

PHOTO 2: The constituent parts of the jig – a simple job of no more than an hour to make.

PHOTO 3: Using a drawing to set the bar of the jig to the correct angle.

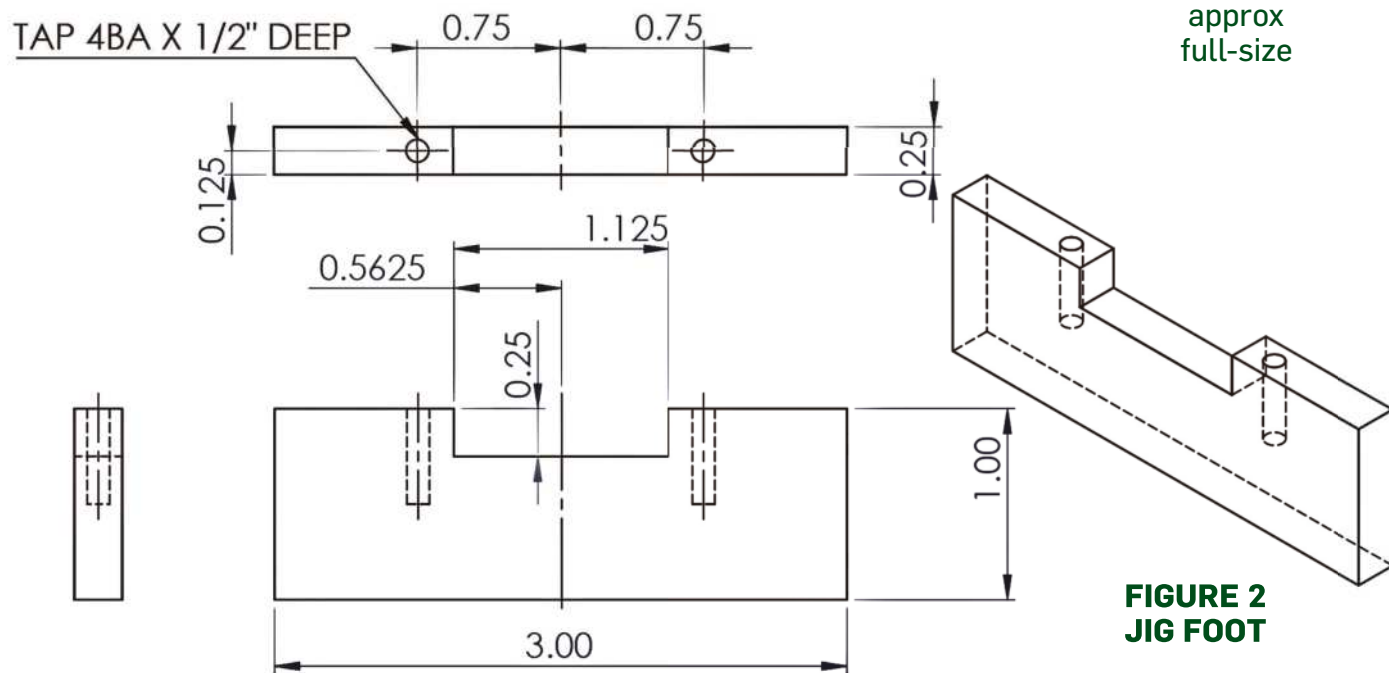
Photos and drawings by the author



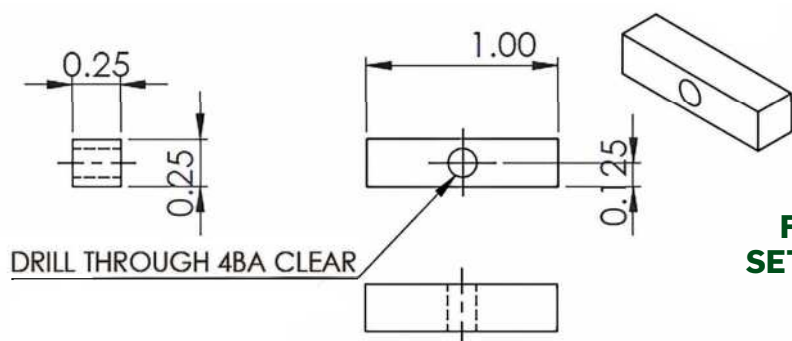


**FIGURE 1
JIG BACKPLATE**

All drawings
reproduced
approx
full-size



**FIGURE 2
JIG FOOT**



**FIGURE 3
SETTING BAR**

Whilst not essential, the ¼-inch deep recess in the top edge is to allow swarf to escape when the jig is in use; without it, you have to keep clearing the swarf out with a small brush. I did not include this recess when I first made my jig – the benefits of having it became apparent when I first used it. Make sure the 3-inch dimension is the same as on the backplate and, again, that the sides are square.

The Setting Bar, shown in **Figure 3**, is a short length of ¼-inch square steel with a 4BA clearance hole drilled through on its centreline. Do not be tempted to make this part significantly shorter or longer. If you make it too short, it might be difficult to align with the drawing; if you make it too long, then it may make it more likely that the angle will change when you place the jig in the machine vice.

None of the above dimensions are critical – the 3-inch width comes from the fact that 3½-inch gauge frames are generally about 2⅞-inch apart so the jig will take inside cylinder blocks if required. The 2-inch height should give sufficient stability to the cylinder in use.

Visual accuracy

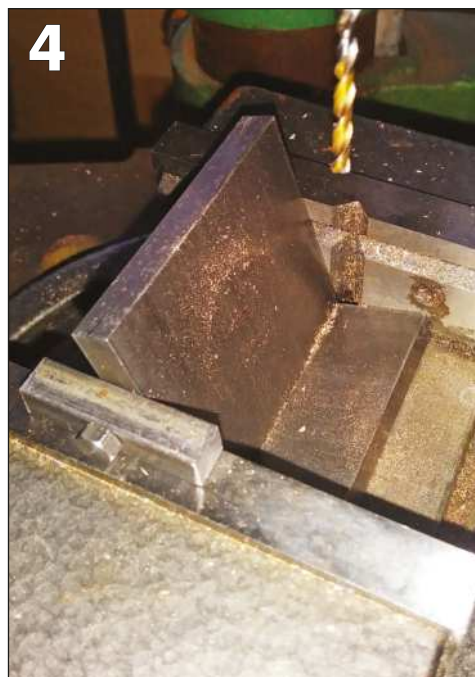
When the jig is in use, the ¼-inch square is set at the appropriate angle as required by the direction of the passages – I didn't even measure the angle but just lined it up by eye from the cylinder drawing (**Photo 3** – but do check that the drawing is properly to scale first!). The angle required is that between the port face and a line perpendicular to the passageway – in almost all cases, this will be the same as the angle between the passageway and the end of the cylinder block.

This being done and the 4BA bolt tightened, the jig is clamped in the machine vice with the ¼-inch square sitting on top of the vice jaws, thus putting the L at the appropriate angle to support the cylinders for drilling the passages.

In **Photo 4**, the jig can be seen in its original form without the 1-inch diameter hole for the Averill port-face or the slot for the swarf. As both arms of the L are clamped in the vice, it must sit squarely.

Each of the cylinders can then be placed in the jig and, with the cylinder held in place by hand, the passages drilled (**Photo 5**). You could clamp them in place with a ¼-inch bolt through the bore and a suitably placed hole in the jig but I didn't find this to be necessary.

As each cylinder is supported in the same way, once the depth stop is set for the first end of the first cylinder, it will not need to be adjusted for the others as the L locates the cylinder in the same place each time.



Check friendly

If, during the drilling of the first passage hole, you want to check if you have gone deep enough, you can lift the cylinder out of the jig and check it, knowing that it will go back in the jig exactly as it came out. Without the slot in the shorter arm, it is necessary to sweep the swarf out of the bottom of the jig each time the cylinder is disturbed as the swarf will prevent the block re-seating properly.

Using this jig, I was able to drill all four sets of passages in about 45 minutes, secure in the knowledge that, once I knew that the first hole had come out in the right place, the others had no option but to follow suit.

Having used the jig on my Southern Maid and finding it worked quite well, I shared its design with Des Adeley, the Vice-President of the National 2½" Gauge Association who I knew would be machining some Averill type cylinders for a 2½-inch gauge Penrhyn narrow gauge engine.

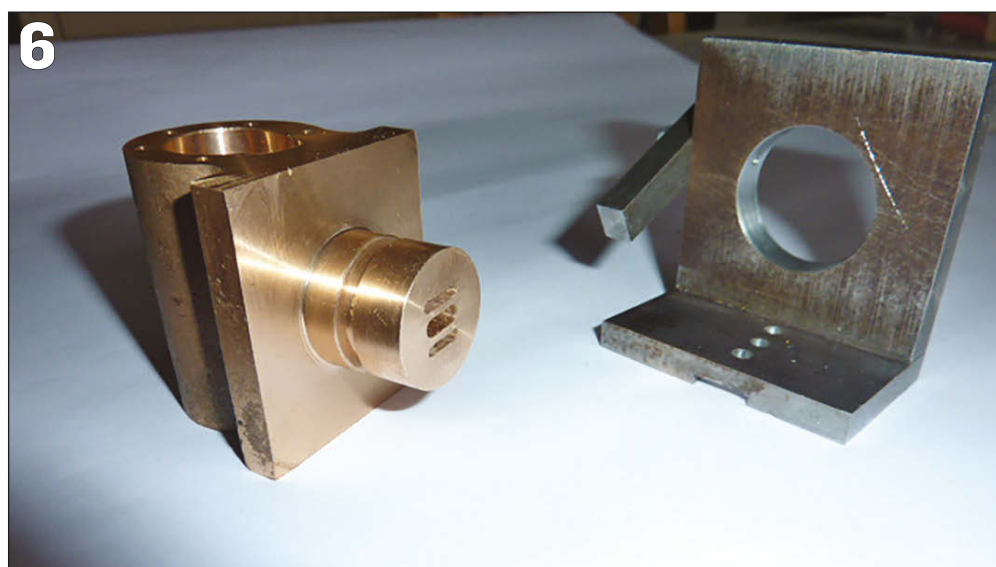


PHOTO 4:

The jig set up in the drill press machine vice.

PHOTO 5:

Drilling the passageways in the cylinder.

PHOTO 6:

The Jig made by Des Adeley with his Averill cylinder block for a narrow gauge loco.

As this locomotive has the wheels inside the frames and the cylinders outside (similar to the 3½-inch gauge 'Lilla'), the offset between the cylinder bolting face and the port face is quite large, as can be seen in his photograph (**Photo 6**).

Uncertain no more

Des made his own version of the jig and, having used it, was quite complimentary, stating that, in his view, it stopped the drilling of passages being a rather hit-or-miss exercise, removing any worry that the drill might break out in the wrong place. The 1-inch diameter hole in the backplate was his idea, prompted by the design of this cylinder block.

In **Photo 6** you can also see some smaller holes he put in the jig foot for a clamping bolt through the bore. The groove you can see on the cylindrical port-face extension is for an O-ring seal between the cylinder and the steam chest. **EIM**

Restoring a Gauge 1 Midland Compound

Anthony continues his workshop restoration of an electrically-powered Gauge 1 locomotive with the tender bodywork on the bench this month.

BY ANTHONY WHITE Part 3 of a short series

In last month's edition describing my restoration of a Gauge 1 Midland Compound, bought on the used market and in need of a lot of work, I focused on the tender bottom end. Now it was time to turn to the bodywork and to fully restore it required total removal of the remaining paint as it interfered with soldering. Doing that did enable me to sort out various basic problems I discovered in various parts of the build, or perhaps repairs with epoxy glue. I was able to repair these and so strengthen everything with soldered joints. After stripping the paint, the whole tender body started to come apart more than ever! I will return to this later.

The buffer beam was part of the main tender body and I unsoldered it from the base of the body with some difficulty, as it was also soldered to the rear ends of the outer frames. It was only this that had stopped the outer frames from coming off completely. But it was an essential job as the centre of the original buffer beam had been seriously cut and bent up to accommodate some sort of plastic knuckle coupling.

Once free of the body it was easy to apply heat to the whole buffer beam assembly and remove the buffers. This usefully removed the oversized duplicated square bases to the buffers. They are a true feature on these prototype tenders but are not the size and thickness that has been modelled.

The buffers, that were actually fully sprung, required a lot of cleaning up as they had gone solid with paint, gunge and glue even after being unsoldered from the buffer beam. After cleaning and removal of it all even the 2BA threads at the rear still needed to be reformed with a die.

Wide of the beam

Once I had the buffers cleaned it was time to make a new buffer beam but I ran into several problems. Firstly the original buffer beam was too wide, easily solved as I made the new one the correct length.

The second was that the buffer centres were 2mm too close – again this was no problem as I had drawings

"The tender buffer beam was positioned too far forward resulting in a massive overhang of the running plate..."



with correct prototype measurements and even bolt and rivet positions marked. But when I had made the new beam and replaced the buffers, I then discovered the reason for the narrowing of the centres – the parts of the buffers behind the beam, with securing 2BA nuts, would no longer fit between the outer frames so a quick redesign was required to solve this.

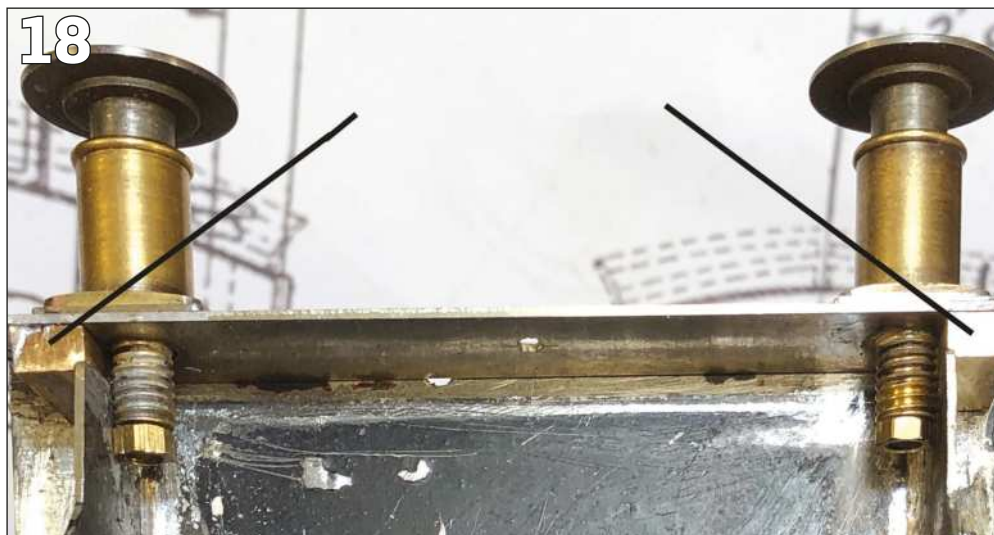
Instead of using the 2BA nuts to hold the buffers to the beam, I eventually (once all the parts were ready and restored to correct dimensions), bolted them in position, soldered the buffer stocks to the beam and then removed the 2BA nut. I replaced the 6BA nut that held the rear of the mobile inner buffer shaft in position with an 8BA nut drilled out and tapped 6BA.

The base of each buffer stock had also been made far too thick for scale and as previously mentioned the square base they were sitting on was too thick at about 2.5mm. I mounted

the buffer stocks in turn on a stub of brass rod that just fitted, fixed it with Super-Glue and gently faced the rear surface down to a scale 1mm. I then made a new pair of new to-scale size base plates to go underneath from 0.7mm nickel-silver, reassembled everything in alignment and sweated them in position, holding them tightly with the 2BA nut at the back as described above.

Removing the 2BA nut enabled everything to fit between the outer frames (Photo 18), whereupon I noticed even more problems. The rear ends of the frames projected below the lower edge of the buffer beam, whereas my LMS drawings and photographs showed this to be flush. I marked the area to be removed and a little work with a file soon corrected this issue.

I then discovered yet another error; the buffer beam was positioned well ahead of its correct position in the prototype and needed to be moved



back by about 2.5mm. I was surprised that I hadn't noticed this before as the running plate extended obviously way beyond the buffer beam. Or put another way the buffer beam was positioned too far forward with a massive overhang of the running plate.

Correcting this in turn now left a large gap between the rear edge of the outer chassis and the buffer beam. To solve this, although the gap would be hidden by the rear steps, I used a solution that not only filled the gap but also acted as a support and positioning block for the back of the rear steps, a suitably sized and shaped piece of brass soldered in position to the rear of the beam.

These act as a most useful stop and support for the back of the rear steps and are highlighted in photo 18, soldered to the rear of the buffer beam. The distortion of the left-hand buffer is fortunately just a camera effect.

Body building

Before re-fixing the buffer beam I turned my attention to the main tender bodywork as it was now seriously beginning to fall apart. I will return to the buffer beam later as it would undergo further alterations.

One unwanted side effect of stripping paint from the tender was that it removed four of the six axlebox and spring castings, all the beams under them and various other joints that had all been glued. It also revealed the considerable number of failed soldered joints; the body itself was starting to fall apart (**Photo 19**).

The first joint I tackled was the outside frame – this had now come off completely on one side and was coming adrift over the whole rear half of the other side. Various other major pieces were also coming apart, particularly the near side of tender from the running plate, the whole of the front assembly and so on.

I carefully cleaned each joint from paint and glue, prepared them for solder with wire brush, scrapers and wire wool, and re-soldered them all to create a more secure box-like structure. I used the same technique to clean up all the inside joints and ran a fresh fillet of solder along each.

This was mostly not too demanding a process but one place that was particularly difficult was the front of the tender just above the running plate. A previous owner or the builder had drilled two holes, you can see these **Photo 19**, and the pressure from the drill had bent the metal to one side.

It would have meant removing the whole front to straighten this, so I cut a thin sheet of wood to hold it from behind and with pressure from a Resistance Soldering Unit (RSU) I

PHOTO 18:

Filling blocks at rear of frames and behind rear steps. The design at rear of buffers now fits between the two outer tender frames.

PHOTO 19:

Starting on the tender body, which was seriously starting to fall apart.

PHOTO 20:

Taken at end of tender rebuild showing the coal plate modifications.

Photos by the author



tack-soldered along the bent side, pressing it against the wood at the rear until it was fully fixed in a straight line. I would have liked to run a fillet of solder all the way along the join but that was not possible as I could not contrive a way of holding the whole length as access was too restricted so had to accept the RSU tacked result. But it would be hidden by the coal plate and brake and water scoop standards – this assembly was the next tidy-up job as it was not a good fit and had some missing parts and incorrect dimensions, although to be fair it was difficult to see any visible change except the two extra supports and even those improvements will be hidden when the loco and tender are coupled together.

To describe the improvements – looking at the collection of photographs I was acquiring I realised that the plate was not supported just

by vertical plates each end, there should be two more supports near the centre so these were added next as shown in **Photo 20**. They were a simple job from pieces of scrap nickel silver but they do need careful measurement before cutting to size and in my case a bit of filing afterwards before soldering them in position under the plate.

I didn't fix this sub-unit to the front of the tender but kept it as a separate unit because it was crucial to matching the height of the cab footplate, the fall plate and the tender. I still needed to see how the height matched the loco when work on that was completed, so yet another sub-assembly piece went into the box of parts for later. In fact even after the loco was completed I kept this as a free-fitting unit because it made coupling and uncoupling the loco and tender an easier task. ►

20



21



I had re-soldered the front buffering beam in position that was seriously coming adrift but then wished I hadn't. While working on this end of the tender and looking at photographs and checking dimensions on drawings, I suddenly realised that miniature buffers had never been fitted so the next task was to create these miniature buffering units to go in the holes.

A litany of errors

I then discovered almost by accident that the holes were in the wrong place, being too far apart, and more unfortunately directly in front of the ends of the inner frame, so anything made would never fit. But also, the buffering beam was actually 8mm too long so I was forced to un-solder it all again and discard it before starting on a completely new beam with correctly spaced apertures to fit the tiny buffer mechanisms (**Photo 20-21**).

The flat beam was easy enough to

PHOTO 21:

The new loco-to-tender buffering gear after construction.

PHOTO 22:

The new buffering beam now fits neatly with the other structures.

PHOTO 23:

Repair to rear running plate where vacuum pipe used to be and replacement lamp iron on rear of tender.

do by means of a paper template with all the holes already marked using the technique described earlier. The buffering gear outer casings were made from 1/4-inch square brass turned at the back for 8mm to 4mm diameter, reversed and drilled to 7mm depth, 2.4mm. The buffers themselves were made from 5mm brass rod turned behind to 2.3mm to fit the casings and centre drilled to accept lengths of 1.2mm nickel-silver rod. This should be clearer by looking at the various parts shown in **Photo 21**.

They are assembled as shown with springs and reduced to a suitable length, the end threaded 12BA to take the retaining nuts. The completed new beam and its buffering gear, showing how it all fits neatly in place, are shown in **Photo 22** although the turnings still need the heads smoothing and slightly doming.

I then tack-soldered this front beam into position and the picture also shows how the new buffering

assemblies now clear the inner frames (the camera was unfortunately tilted distorting the appearance) and how the whole front end begins to look more like the prototype as visible in photo 20.

Once the main body structure was secured together with the beams both ends, I felt that the main shape was strong and secure and it was time to move on to work on some more of the finer detail.

Vacuum packed

A dilemma that I now faced and associated with the rear buffer beam was the position of the vacuum pipe – in my original model it was on the left side looking towards the back of the tender, whereas in all the photos and drawings I had it was on the right of the central-placed coupling. Should I attempt to fill the filed notch in the running plate or leave it on this side?

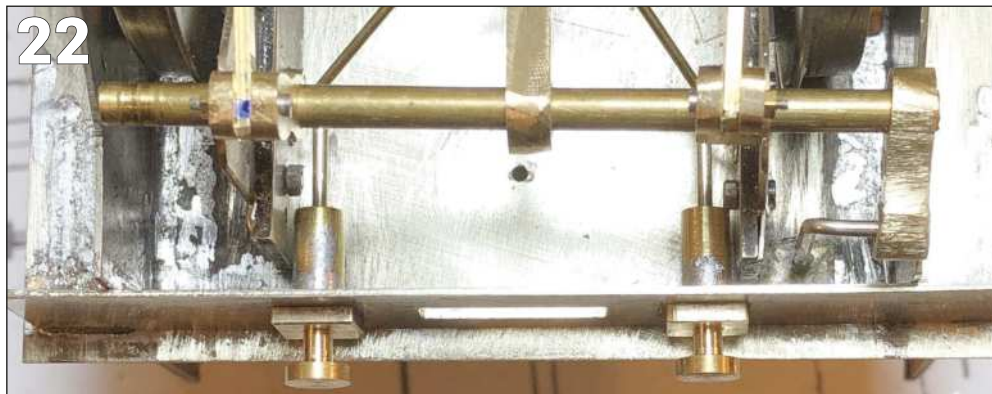
I decided to correct it but the question was how to tackle filling in the missing part of the thin rear running plate where the vacuum pipe had been. It would have been a lot easier to do this before replacing the buffer beam, and I wished I had made this a screw-on fitting, which in fact I did undertake later as I will describe.

Meanwhile I filled the round gap filed into the running plate with a tightly fitting piece of brass rod, flush as possible with the upper surface, soldered in position, then with a saw removed the surplus rod from the underside and fine filed everything smooth above and below. In **Photo 23** you can just see my first attempt, well to the left of the lamp iron, with two small remaining indentations.

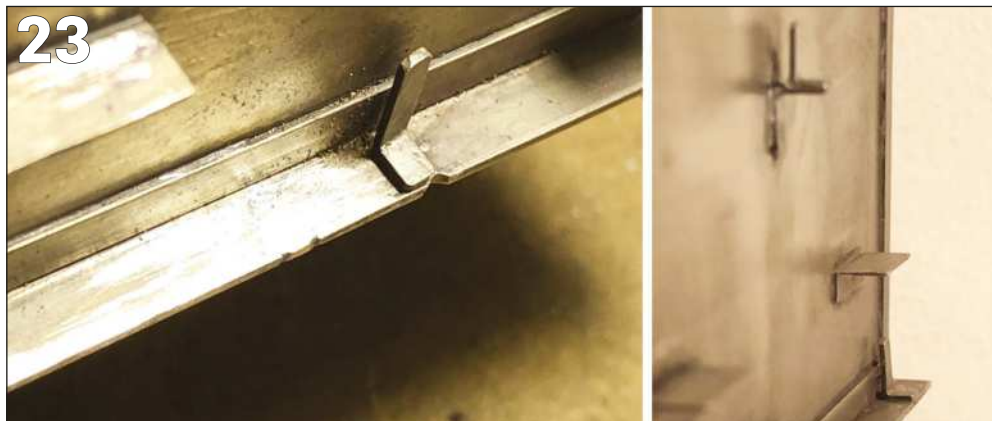
A missing lamp iron higher on the back of the tender was trickier to fix, the remains looked as if it had originally been a brass casting but I much prefer tin-plated steel for these fittings – it is not only stronger but doesn't so easily suffer 'bending fatigue' and break off. Making it from a strip of tinplate 2mm wide with appropriate bends is easy enough but soldering it on, even after tinning both parts is very tricky even with an RSU. It took three goes to get it lined up perfectly to the pencil marks I had drawn to assist, visible in **Photo 23**. Do ensure you get such things visually correct before moving on or they will forever irritate you... **EIM**

■ Next month: Anthony completes his tender work, tackling a host of vital details. Parts 1 and 2 of this series appeared in the April and May editions of **EIM** – digital back issues can be downloaded or printed copies ordered from www.world-of-railways.co.uk/store/back-issues/engineering-in-miniature or by calling 01778 392484.

22



23



A freelance traction engine in 3-inch scale

Jan-Eric continues his traction engine build this month by returning to the boiler, making and installing the propane burners and finishing it off.

BY JAN-ERIC NYSTRÖM Part Nine of a series

Back in part 2 of this series, in the October 2021 issue of *EIM*, I carried out the main construction work on my traction engine boiler – now it was time to return to the boiler to finish it and install the burners. As mentioned earlier, I plan to run this traction engine on propane, since it has proven to be a very trustworthy and hassle-free fuel for all three of the live-steam locomotives I have built.

I re-used the burner design from my Ten-wheeler, namely the 'Swiss Cheese' propane burners – they got their name from the many holes... They have performed well in that loco for seven running seasons as I write, so I decided to use a burner type that I know to work well, in this project too.

I decided, however, to make a slight modification to the design in order to be able to adjust the shape of the flame – the little yellow cone-shaped bolt seen in **Figure 4** can be screwed in or out of the burner body, changing the shape of the flame, making it either wider and lower, or higher and narrower.

The cone does not affect the 'auxiliary' flames emanating from the very lowest holes (slits, actually) in the burner, so the firebox will be heated both at its sides as well as its top. I built a very simple manifold from flattened copper tube, and tested the four burners in a staggered alignment, **Photo 87**. Combined, these four flames should heat the entire firebox evenly, with enough heating power to spare.

Changing pressure

By mail order, I had obtained a small and good-looking model pressure gauge, with a stylish brass bezel, quite unlike the utilitarian gauges available locally. The only problem was the pressure scale – it was in PSI only, and I want my gauges to show the reading in Bars (in other words, 'atmospheres'), simply because I'm used to that.

Since the gauge bezel was easy to open, I designed a new scale on my computer, **Figure 5**. In order for it to be durable in the hot and humid atmosphere where it will reside, I printed the scale onto adhesive plastic,

not paper, using a colour laser printer. Note that an inkjet won't do, the ink won't dry on a plastic surface! Note also that you should never feed a sheet of contact-adhesive plastic into a laser printer as such, since there is a risk of it softening in the heat of the fusing unit, getting scrunched, and sticking to the mechanism inside the printer! Yes, I experienced that once... It was quite a chore to get the printer back in shape again. Thus, never again!

So, this time I printed the scale on a sheet of paper first, and then attached a small piece of the adhesive plastic to the paper with a piece of masking tape, positioning it over the printed image, as seen in **Photo 88**.

Now, running the sheet through the printer once more, the scale was printed in the right position on the small piece of plastic, held securely in place by the tape. Note that the taped edge of course must be pointing in the direction of the paper feed – otherwise there would be a lot of trouble!

Removing the small plastic label from the full sheet of paper, I could attach a piece of transparent adhesive plastic on top of the label, making it resistant to damage (a laser-printed image on plastic is very easily rubbed off). After cutting the scale to shape and removing the waxed backing paper, I attached it on the face of the gauge, **Photo 89**. Cutting away the part marked with dotted lines in **Figure 5** meant that I didn't even have to remove the pointer from the gauge.

Boiler completion

With burners and pressure gauge in order, it was time to do the finishing work on the copper-nickel, 'CuNi' boiler (see my warnings in part two of this series, and why I don't recommend using CuNi for making your own boiler...)

As you may remember, I had to construct the boiler shell almost at the very beginning of this project, since everything else is attached to it. On a locomotive, the boiler is one of the last parts to be installed, but when building a traction engine, the boiler shell and its outer firebox sides must be available for the work to proceed. ▶

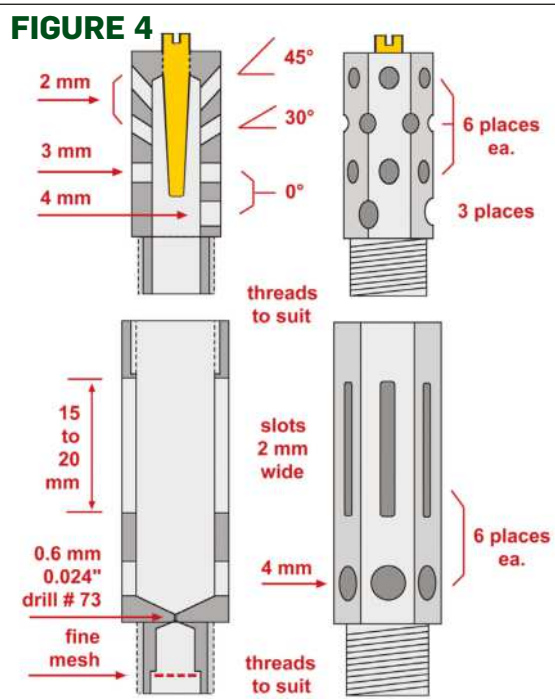
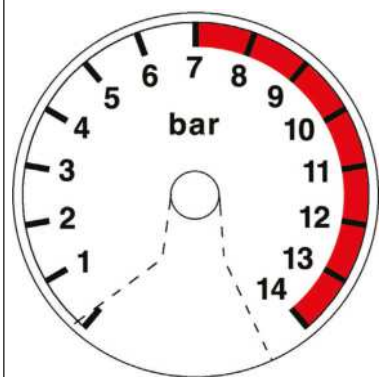


FIGURE 4: Burner design similar to that used in Jan-Eric's ten-wheeler loco – addition marked in yellow.

PHOTO 87: Four burners on a manifold made of flattened copper tubing, with threaded brass nipples silver-soldered on.



FIGURE 5



I had already drilled the front tubeplate, but now I added a strong stay, TIG-welded to the water side of the tube plate (**Photo 90**), and I also added some TIG filler material to make the thread for the dry pipe bushing a bit deeper (top right in the photo). The plate is 3mm thick, so I built it up to double thickness for the threaded bushing.

Aligning all the tubes (already welded to the inner firebox tubeplate) required a bit of wiggling around, but holding the tubeplate down with a nut on a long threaded rod passing through the central tube, **Photo 91**, made it a lot easier – soon I had all the tubes in place, ready for TIG welding, **Photo 92**.

When welding thin copper tubes, it is very easy to burn through the tube wall, and since the tubes are already attached at the other end, that would be a catastrophe! Copper has a very high thermal conductivity, so when the edge of a tube is melting at the point of the weld, the copper is already almost melting a bit further away. Thus, I did this work very carefully, just a short part of the seam before letting the metal cool.

Fortunately, my TIG welder has an automatic, adjustable “pulse” on-off feature, which made the job a lot

88

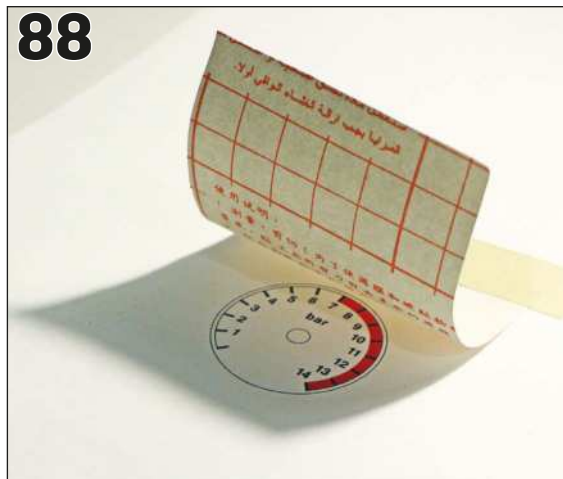


FIGURE 5: The new scale for the boiler pressure gauge, to be laser-printed on adhesive plastic.

PHOTO 88: A piece of adhesive plastic (still attached to its waxed backing sheet) is taped in position over a printed scale.

PHOTO 89: Neat-looking brass-encased model pressure gauge has a new scale in bars instead of psi.

PHOTO 90: Front tubeplate. Note the substantial stay, as well as the welded and threaded reinforcement for the dry pipe bushing at top right.

PHOTO 91: Threaded rod keeps the tubeplate secured as the fire tubes are wiggled in place.

PHOTO 92: All the fire tubes are in place, ready to be TIG-welded to the tubeplate.

easier and the risk was much diminished. The two large CuNi flues were not as critical in this respect, since they conduct heat six times slower than pure copper.

Photo 93 shows the result – definitely not as beautiful as the silver-soldered copper work presented by other builders here in **EIM**, but it works! Note the substantial fillet of weld filler metal (also a CuNi alloy) all around the tubeplate, which has fused it securely to the inside of the boiler tube; this weld cannot be inspected from the inside (except with a borescope or ‘snake’ camera – see the December 2019 issue), so I made sure it was a proper weld, with ample penetration into the base metal.

Photo 94 shows the inner firebox

90



91



92





PHOTO 93: Finished job – the boiler tubes are now welded to the front tubeplate.



PHOTO 94: The inner firebox is held in place with the first four welded stay bolts.

PHOTO 95: A leaking stay bolt seam was found during the hydraulic test.

PHOTO 96: The foundation ring is made of four strips cut from CuNi plate, securely welded in place.

Photos and diagrams in this feature by the author



held in place by the first four welded stay bolts. My CuNi work is nowhere near as neat as what many other builders produce using silver solder, when the plates need to be formed to perfection, and tolerances must be tightly held for the solder to penetrate by capillary action. Since a welded seam can easily bridge a gap of a millimetre or even more, my roughly hewn CuNi plates didn't need to be as nicely finished, so I just used my trusty angle grinder to cut them to shape, again following my 'quick-and-dirty' philosophy with my usual warning about the protection needed when using an angle grinder...

After the foundation ring was welded in place and all openings plugged, I could perform a first check for leaks – I pressurised the boiler to around one bar/15psi with air from my compressor (that's still a safe air pressure for an untested boiler of this size), and 'painted' all welds with a brush dipped in soapy water. The inevitably ensuing bubbles revealed a few pinhole leaks, which were marked with a felt-tip pen and once the boiler had been depressurised were quickly welded over.

Leak revealed

The all-important hydraulic test was next in turn. I had built a little hand pump incorporating a pressure gauge reading up to 35 bars/500psi. I filled the boiler to the brim with cold water, taking care to remove all air bubbles before plugging up. When pumping, I noticed a mist of water in the firebox; I had found one leak not revealed by the soap water test, **Photo 95**.

A defect in the weld, plugged with a small speck of slag or oxide which

was dislodged by the higher pressure, was probably the culprit. This leak was again easily fixed after draining the boiler and re-welding over the stay. I filled the boiler again, and the intended test pressure of 18 bars/270psi was then reached, and held, with just a few strokes of the pump.

Since this particular CuNi alloy has an ultimate tensile strength in the same ballpark as ordinary mild steel, I am confident I now have a boiler which will stand up to both a working steam pressure of 7 bars/100psi, as well as the mechanical stresses from the front wheels, which are attached to the boiler's smokebox via the saddle.

Photo 96 shows the underside of the firebox after all the welding was done. Note the short bolts sticking out from the sides of the boiler – using them, the hornplates are bolted to the sides of the boiler.

There is a brass plug in the top of the inner firebox plate (also visible in Photo 94); this will be replaced with a fusible plug before the traction engine is steamed up. That plug contains a core of pure tin that melts at 232 degrees C/ 450 degrees F, well above the water temperature of 160 degrees C /320 degrees F at 7 bars/100psi steam pressure. In a case of low water, the plug will melt open and release the steam into the firebox, alarming the driver of the low water condition. Safety first! **EIM**

■ Parts one to eight of this series appeared in the September 2021 to April 2022 issues of **EIM** – we gave Jan-Eric a break last month and added that he would next describe the fabrication of the rather unusual cylinder assembly – due to nothing more than the Editor's incompetence that episode will now appear next month!

To read previous parts of the series you can download digital back issues or order printed copies from www.world-of-railways.co.uk/store/back-issues/engineering-in-miniature or by calling 01778 392484.



Circular means to parallelism



I read with interest an article in the March Edition of **EIM** showing parallel bars set in a three-jaw chuck (*Martin Gearing's feed pump & double clack for the EIM Steam Plant – Ed*).

Obviously the parallel bars will need to be removed before turning, with the possibility of the component losing its accuracy and

marking the previously machined surface.

My solution is to make circular parallels which can be left in position and will be able to accommodate measurements for dimension and parallelism.

I hope the photos explain it all.

Mike Furber

REVIEWS

The Swanley New Barn Railway at 35

By Jonathan James

This is an attractive and inexpensive softback survey of one of the UK's leading 7¼-inch gauge public lines – the Swanley New Barn Railway has been running around its park in the Kent town since 1983, celebrating a necessarily quiet 35th anniversary last year.

The author, known for his passion for miniature lines, has visited this particular railway many times and is able to provide an in-depth study that benefits from plenty of colour photos alongside the narrative.

The book starts with a compact history of the railway, added to greatly by the memories of early members, and including four route maps showing how the route has developed over the years.

Readers are taken on a photographic trip along the line before a chapter describing

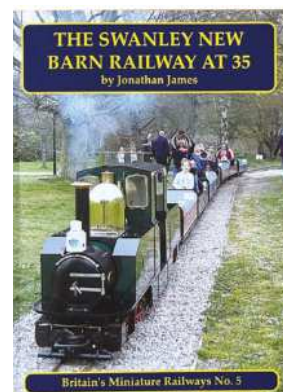
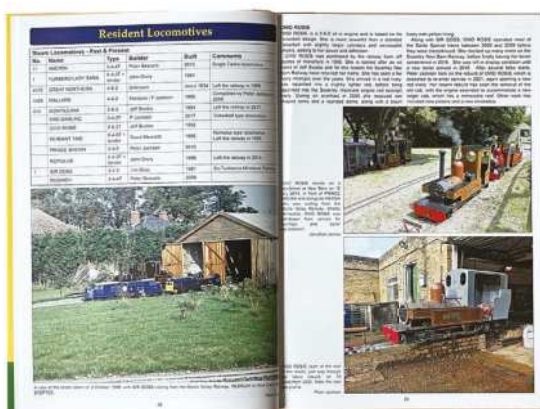
how the railway is operated. The resident 12 steam locos get individual coverage with past and present i/c engines also covered in detail, along with the rolling stock. An excellent

little book on a seldom covered subject. **AC**

ISBN 9781 90034 090 8 7 Price £16.95

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Miniature Railways Review 2021

Compiled by Jonathan James

A productive time for Mr James who is also responsible for this useful review of miniature lines, a special edition of the Narrow Gauge Railway Society magazine *The Narrow Gauge* distributed to members. This is according to Jonathan the result of an excess of miniature railway reports sent in by members. The Society has previously put out only an annual listing so this 32 page booklet with plenty of colour photos is a step up.

Close to 120 lines are listed, from model engineering society tracks to major 12¼-inch and 15-inch lines such as at Fairbourne, Ravenglass and Romney and the 20-inch North Bay Railway in Scarborough.

It's an interesting overview – our only thoughts would be that a county by county listing would be more useful than the simply A to Z format employed, especially as no

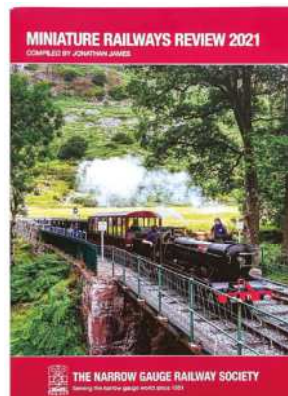
contact details for the railways are included. However at £8.50 it's well worth the outlay – but even better would be to join the NGRS and to receive such publications and regular miniature railway updates as part of the

bi-monthly narrow gauge newsletter. **AC**

ISBN 9781 913837 04 4 Price £8.50

Published by Narrow Gauge Railway Society.

Available via www.ngrs.org/book-sales-tng-special-issues/



Plenty of places to ride miniatures

Judging by the event reports, and the details of forthcoming ones flooding into our mail box the club scene is back doing what it does best...

COMPILED BY ANDREW CHARMAN

The month of June and we are on the point of welcoming summer (though you would not believe it, looking out of the window at EIM Towers as these words are written – Wales's famed 'liquid sunshine' is very much the order of the day today...). Having got back into the 'swing of things' after two years of largely inactivity, several clubs are telling us that they've been very busy, welcoming back the public in their droves since opening up again, most of them getting going at Easter.

The good news is that all this activity also means more events for us model engineers to enjoy with like-minded souls – having had two disrupted seasons perhaps we now appreciate what we have a little more. It's good to be taking up a whole page with diary dates again, both public running and special events – our roving reporter John Arrowsmith reports from the recent GL5 mainline rally at the **East Somerset SMEE** in this issue and there will be plenty to keep him busy in coming weeks – he'll be spoilt for choice...

For example this month there is the **North Wilts ME's** invitation Summer Rally at the Coate Water Country Park in Swindon on 11th-12th June, and a week later that favourite for all fans of a certain narrow gauge model engine, the 29th Sweet Pea Rally, this year hosted by the **Fareham & District SME** on 18th-19th of June. Fareham members promise that it will be "the usual fun event for all concerned," which we don't doubt! Full details are on the Fareham club website at www.sweet-pea-2022.fdsme.org.uk

Meanwhile, club diary secretaries are finally getting back into the swing of things too and remembering to send their vital info to us!

All roads lead to Wales

It's good to see the return of a full weekend for the Welsh Rally held by the **Cardiff ME**. This year to avoid an unnecessary clash of dates, the 30th running of this rally is being held over the weekend of 18th-19th June.

The club's site has a raised-level 3½ and 5-inch track and 7¼-inch ground-level running lines. In the long two years since the last full rally there have been some significant changes on the site including a longer run on the 7¼-inch ground-level track which has

also gained an additional running line.

New signalling gantries have been erected throughout while the ever popular tram line has also been redesigned, moving the station to a passing loop at the centre.

Cardiff members tell us that the rally routinely attracts visitors from far and wide, often bringing around 30 locomotives and half a dozen scale traction engines, creating a fascinating and busy scene. Polly Models and Keatley Metals will also be on hand at what sounds like a fun event – more information is on the Cardiff website www.cardiffmes.co.uk and the Facebook page, www.facebook.com/Cardiffmes.

This month's *Club & Track News* pages are shaping up a bit like a coming events guide but to be honest, we don't mind at all, we've waited long enough for some events! On the same weekend as Cardiff the **Melton Mowbray ME** is holding its Steam Show at Whissendine Sports Club ground, which is in Melton Road, Whissendine LE15 7EU.

This is another club with a newly extended line, this time 5-inch and 7¼-inch gauge ground-level as well as a 5-inch gauge raised track which are expected to feature a variety of steam and electric traction all weekend. Miniature traction engines and steam wagons will be running on the sports field and will also undertake their traditional road runs into the village at around mid-day on both days. Model aircraft, model railways and slot cars will also be on display at what



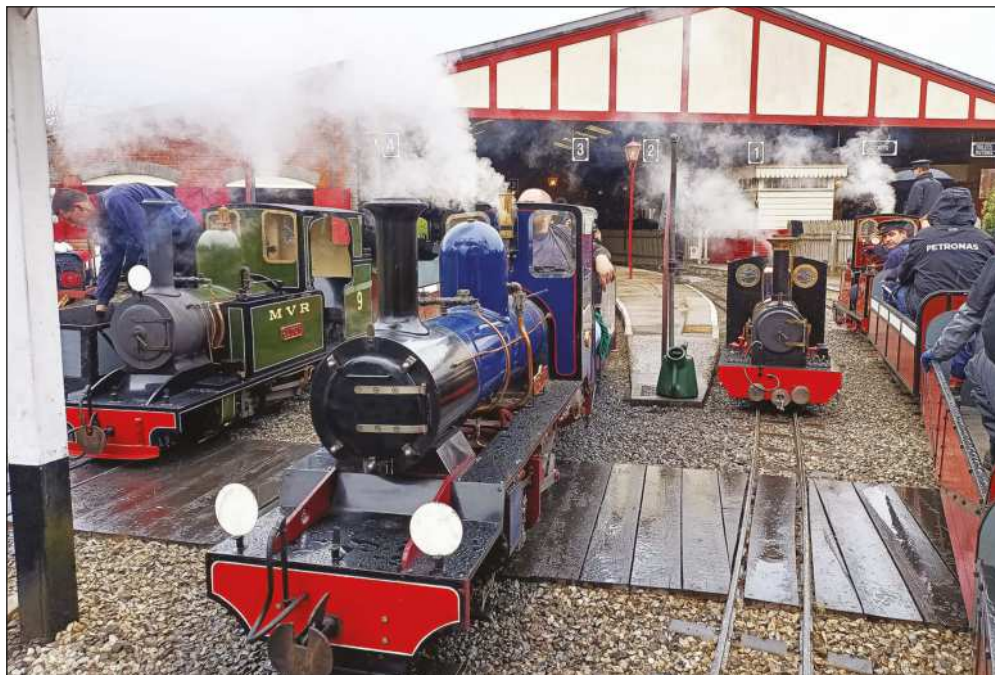
ABOVE: First open day of 2022 at Ickenham SME on 2nd April saw plenty of visitors.

BELOW: The youngsters loved the 'horse powered' slate wagon, well known in ME circles of course! Photos by Jonathan James

sounds like a wide-ranging show. The website for more information is mmdmes.wixsite.com/home and like many clubs these days Melton Mowbray is also on Facebook

Finally for now in terms of coming events (well, apart from the listings in the diary on page 43) one to bookmark for later in the year. If you were impressed by the premises of the **East Somerset SMEE** in John's GL5 report, a good time to check them out for yourself could well be the Model Engineers' Open Weekend the club is planning at its track, located





within the Bath & West Showground near Shepton Mallet, on 24th-25th September. Visitors are promised lots of action on the half-mile long 5-inch and 7¼-inch gauge track, in the 5-inch gauge shunting yards and on the extensive tarmac network that will feature steam road vehicles. Note, however, that this event will be for booked visitors only, with no public running. For further details and booking forms, contact Michael Malleon on 01747 860719 or openweekend@essmee.org.uk

Turning to the latest selection of club newsletters arriving at **EIM** Towers, it's a shame to see the old problem of damage to our model engineering sites isn't going away, with the **Teeside Small Gauge Railway** and the **Worthing & District SME** both suffering from vandalism and burglary in recent times. Mind

ABOVE: Lots of steam from lots of locos at the Moors Valley Railway's Visiting Engines weekend. Photo: James Charman

BELOW: Lincoln members have been busy ensuring road visitors don't get bogged down unloading their precious, and heavy, cargoes. Photo: Tony Cass/Lincoln ME

you we admire the attitude of the Worthing newsletter editor who reports that a couple of months after the break-in the club suffered "another crisis" when the Wednesday regulars stopped for a teabreak and in opening the biscuit tin found it to be virtually empty... Now that is serious...

Also notable from the Teeside newsletter is another member taking on a part-built loco project, in this case an LBSC Speedy design, a 2-6-4 tank loco in 5-inch gauge. This seems to be a growing trend, making good other people's failed dreams and in the process providing oneself with a loco without the expense in cash, effort and time that building from scratch entails.

It's worth adding too that if you do take on such a project, it can be prudent to take copious notes and photos of what you do to make the

model a runner – usually such projects reveal hidden challenges and **EIM** readers enjoy finding out how such challenges were solved, in what often prove to be highly interesting features. We have cash waiting!

Good news in the latest edition of the **Lincoln & District ME's** newsletter, with the awarding of some £858 to the club in a latest round of local community grants provided by the Co-op. Such funding is really helpful to clubs, especially after the financial pressures of recent times, and there are plenty of grant opportunities out there if a member or team of members is willing to do the legwork to seek them out. Okay it's not model engineering, but it could well be a means to ensure we can keep on model engineering...

Lincoln has been busy on more improvements to its facilities in recent times – the two pictures sent in by member Tony Cass, who has shared a Welshpool & Llanfair footplate with yours truly in the past, shows the process of laying a new concrete slab at the North Scarle track site, to support road vehicles reversing in to use the loco lift to unload their precious cargoes down to track level – the blue-coloured lift can be seen temporarily moved to one side in the second picture.

One club that seems to be forever improving its facilities is the **Rugby ME**, and as usual the latest editions of its monthly newsletter feature additions such as the two new storage sidings currently being added to the ground-level track, a new pathway with two track crossings and the planting of numerous trees.

On guard

More mundane but safety-critical matters have also been going on at Rugby in recent times – the forest of high-vis orange jackets in the first picture above right mark a day's pre-season guards training held on 3rd April. The event, held for both new guards and those wanting a refresher course, consisted of both classroom and practical training, and apparently this will be followed by 'on-the-job' coaching and assessment throughout the public running season. All praised the excellent work putting the day together from Rugby members Holly and Rolf, the latter of which has also shared a W&L footplate with yours truly – it's a small world...

Rugby held its first public running day of the year on Easter Monday and a fine day certainly brought out the visitors – all tickets had to be pre-booked and according to the club newsletter were all snapped up three days before the event. Much activity ensued, especially on the newly



extended raised-level track and the club newsletter editor commented; "It was good to see the public at the track in April for the first time since 2019..."

On the subject of safety, we note that the Gauge 1 Guild has issued some new safety advice regarding liquid fuels, after what was described as a recent "meths fuel incident." One cannot be too careful with such things, especially as while most of the 16mm scale community has moved on to gas, there is plenty of meths fuelling still going on in Gauge 1 and indeed older 16mm locos. Thankfully today we very rarely see unfortunate incidents of locos catching alight, unlike the "good old" but really not so good old days when such incidents were more common. Despite this we still need to be vigilant, especially when running for the public...

No doubt many clubs may be planning some special running and attractions for the extra bank holiday we get this month as part of Her Majesty The Queen's Platinum Jubilee celebrations, though hopefully they won't be following the example of the Severn Valley Railway and painting locos purple – 'Taw Valley' looks ghastly though apparently it's very much bringing in the punters...

Diamond days

For one club, however, it's not about platinum, or purple, but diamonds. The **Southampton SME** celebrated its 60th anniversary on 10th April with a birthday running day on which a special edition of the club newsletter commented; "It was great to see so many old and new faces coming together to mark the occasion," adding that many people pulled together to bring some community atmosphere back to the track, which is good to hear.

Judging by the many pictures in the special edition newsletter, everyone had a great day, with a wide variety of locos running and even a recreation of the very first train. But a note to Southampton, and every other club – when you have special occasions like this, send a couple of pictures to us! They would be perfect for these pages, which we can never get enough good photos for...

Also enjoying a very good Easter was the **York DSME**. The club staged a family fun day at its track alongside the East Coast main line, and raised more than £500 as well as signing up four new members.

Your editor particularly noted one line in the report which stated "This was the first family fun day since before lockdown and an estimated 175 visitors turned up and had a great time – some said they'd never heard of us before so the *Yorkshire Post*

"'Taw Valley' looks ghastly though apparently it's very much bringing in the punters..."

ABOVE: A sea of orange as guards undergo some essential pre-season training at the Rugby club.

ABOVE RIGHT: Of course you can't have a training day without at least one ride...

RIGHT: Rugby's first open day of the year in April saw many visitors trying out the newly extended raised-level track.

Photos: Rugby ME



write-up the day before was a great help." Something I learnt from both my journalism career and more than 25 years of acting as the voluntary press officer for the Welshpool & Llanfair – never under-estimate the importance of publicity, a little effort can have very big results! Indeed York editor Roger Backhouse devotes a page to this very subject with ourselves and our fellows at *Model Engineer* getting a mention – thanks for the namecheck Roger!

Lot of bottle

A fascinating article in the York newsletter by Bob Lovett describes his efforts at creating a train in a bottle

– well why not, why should such things just be reserved for ships? Okay it may be a bit too miniature for the average **EIM** reader but such an ornament placed on a mantelpiece or shelf would certainly create a talking point among visitors...

I do like the names that get attached to various bits of miniature engineering infrastructure, such as in the latest edition of the newsletter from the **Bournemouth DSME**. In his front-page report club chairman Peter Burton offers his thanks to members Bob Devereaux and Derek Sawyer "who have been carrying out maintenance to the bendy beam recently." Bendy beam? Not a phrase





I'm familiar with and not one I can find in the various railway operating guides in the **EIM** library...

Thankfully Peter offers an explanation. The Bendy Beam is a movable section of track, that takes locos from the steaming bays spur to the main line, or across to the siding. "It really is a superb piece of engineering and works in all weathers and temperatures," Peter adds. You know what's coming next... We want to see pictures, and some notes too on how the novel device was conceived and works, if any Bournemouth member feels up to the task...

One sad aspect of the latest Bournemouth newsletter is a tribute to Peggy Ganderton, a long-time

member with her husband Dick. Initially helping to make the tea on running days, Peggy soon used her experience in catering to the Society's benefit, and ended up as one of the longest-serving committee members, serving some 25 years. A salutary reminder that it's not just the trains front and centre that make our vocation tick, there are so many unsung heroes behind the scenes performing roles that are just as vital – I'll bet many a club can identify their own Peggy...

Another excellent advantage of being in a club is highlighted by Jim Jennings, president of the **Bradford ME**, in his 'Prescription' heading the April edition of the club's *Monthly*

"It really is a superb piece of engineering and works in all weathers and temperatures..."

Bulletin. "A constant refrain of mine is that we in the society have a very large, but often hidden, pool of expert knowledge and skill," Jim writes.

As just one example he quotes at least two talks given by members over the years on batteries and their care; "These have increased my very rudimentary knowledge on this subject enormously, one of many areas where membership of BMES has been beneficial to me."

Hear hear – perhaps not appreciated enough is the huge knowledge base that exists within the average club, free for any member to tap into. If you have a question about any model engineering matter, it's a fair bet that someone in the ranks will have been there, done it and found that answer...

Not so many newsletters from outside British shores this month, but we can always rely on the *Smokebox* from the **Centurion SME** in South Africa. And it's good to read that full recovery from the dreaded pandemic seems to be well underway across the globe too. "March was an excellent month for the club, with good weather and busy running days," reports chairman Leon Kamffer, adding that Covid restrictions are slowly being relaxed "and hopefully we can return to some form of normality in the future." Hang in there folks, from our experience in the UK a return to normality is achievable...

Next generation

Finally for this month's round-up we include a picture from the Visiting Engines Weekend at the **Moors Valley Railway**, held on the 7¼-inch gauge line near Ringwood in Hampshire over the May bank holiday weekend and with the number of locos in steam stretching into double figures.

The picture was taken by Charman Junior, the editor's son James, on a day out for our grandson Charlie. He's not 2½ yet but Charlie is already a dyed-in-the-wool rail enthusiast, who loves being around trains. Even at home he has already progressed from watching *Thomas the Tank Engine* on TV – if they want to keep him quiet, James and Sophie put on *Penny Steam*, made by someone who basically spends his time travelling round the country with his dog, filming mostly narrow gauge railways and posting them on Youtube – they are very good, have a look at www.youtube.com/user/pennysteam/videos

I'm proud of my boy – clearly we instilled in him the proper way to bring up children! Future model engineer? One can but hope... Enjoy your month, and why not go visit some club open days, take some photos and send them in? **EIM**

THIS PAGE:

Roving reporter Phil Barnes was present when the Ingfield Manor Railway began using its new extension on Easter Sunday. These three pictures were taken on the extension to the private 10¼-inch gauge line near Billingshurst in Sussex. Phil tells us it is L-shaped and around 400 yards long.



DIARY

As previously reported the diary has returned after a two-year absence but readers should be aware that we are only publishing dates that have been confirmed, and with the continuing uncertainty over the decline of the Covid pandemic we strongly recommend that readers check with the club or track concerned just before travelling to any events or meetings.

EVERY SATURDAY

(Weather permitting)

Sussex MLS public running, Beech Hurst Gardens, Haywards Heath RH16 4BB, 2-5pm

EVERY SUNDAY

(Weather permitting)

North Wilts ME public running, Coate Water Country Pk, East Swindon, SN3 6FG, 11am-5pm

Ryedale ME public running, Gilling East, North Yorks YO02 4JJ

Southampton SME public running, Nursery Rd, Southampton SO18 1PO 10.30am-4pm

JUNE

1 Bradford ME RC loco competition and evening running, Northcliffe Railway, Shipley BD18 3DD, 7.30pm

1 Bristol SME meeting, Investment casting in Jewellery making by Jeff Gearing, Begbrook Social Club, Stapleton, Bristol BS16 1HY, 7.30pm

2 Guildford ME public running, Stoke Pk, Guildford GU1 1TU, 10am-1pm

4 Tiverton & Dist MES running, Rackenford, EX16 8EF, contact Chris Catley 01884 798370, www.tivertonmodelengineering.co.uk

4 Cardiff ME platinum anniversary (Sat), open day (Sun), Heath Pk, Cardiff CF14 4AW

5 Bradford ME Friends of Northcliffe 'big lunch', Northcliffe Railway, Shipley BD18 3DD, noon-3pm

5 Bristol SME Club Day, Ashton Court Railway, Clifton Lodge Gate, BS8 3PX

5 Guildford ME Small Model Steam Engine Group open meeting, Stoke Pk, Guildford GU1 1TU, 2-5pm

5 Plymouth MS public running, Goodwin Pk, PL6 6RE, 2-4.30pm

5 Romney Marsh ME Jubilee Track Meeting, Rolfe Lane, New Romney, Kent, from 12 noon

5 Rugby ME members running, Onley Lane, Rugby CV22 5QD

9 Worthing ME Club Meeting, Field Place, The Boulevard, Worthing BN13 1NP 7.30pm

9 Ryedale ME Cinderbarrow GL5 meeting, Gilling East, North Yorks YO02 4JJ

10 Tiverton & Dist MES afternoon/evening run, Rackenford, EX16 8EF, contact Chris Catley 01884 798370, www.tivertonmodelengineering.co.uk

11 North Wilts ME Invitation Summer Rally, Coate Water Country Pk, Swindon SN3 6AA

12 2½" Gauge Association Rally, Rugby ME, Onley Lane, Rugby CV22 5QD, from 10am

12 Bristol SME public running, Ashton Court Railway, Clifton Lodge Gate, BS8 3PX, noon-5pm

12 Guildford ME public running, Stoke Pk, Guildford GU1 1TU, 10am-1pm

12 Havering Miniature Railway Club public running, 11am-4pm, Lodge Farm Park, Romford. RM2 5AD

12 Hereford SME public running, Broomy Hill, Hereford HR4 0LJ, <https://hsme.co.uk/> noon-4.30pm

12 Lincoln & District ME running at car boot sale, North Scarle playing field, LN6 9ER

12 Worthing ME public running, Field Place, The Boulevard, Worthing BN13 1NP 2-5pm

18 Littlelec 2022, Reading SME, Prospect Pk, Reading RG30 2BE

18 Sweet Pea Rally, Fareham & District ME, Titchfield, Fareham, Surrey PO15 5DZ

18 Melton Mowbray ME Steam Show, Whissendine Sports Club, LE15 7EU

18 30th Welsh Locomotive Rally, Cardiff ME, Heath Park, Cardiff CF14 4AW

19 Bradford ME public running, Northcliffe Rly, Shipley BD18 3DD, members 11.30am, public 1.30pm

19 Bristol SME public running, Ashton Court Railway, Clifton Lodge Gate, BS8 3PX, noon-5pm

19 Plymouth MS public running, Goodwin Pk, PL6 6RE, 2-4.30pm

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

19 Tiverton & Dist MES running, Rackenford, EX16 8EF, contact Chris Catley 01884 798370, www.tivertonmodelengineering.co.uk

21 Romney Marsh ME Midsummer Barbecue, Rolfe Lane, New Romney, Kent, 5pm

23 Worthing ME Club Meeting, Field Place, The Boulevard, Worthing BN13 1NP 7.30pm

25 Cardiff ME Steam-up & family day, Heath Pk, Cardiff CF14 4AW

25 SMEE Model Running incl Gauge 1, Marshall House, London, 2.30pm

26 Havering Miniature Railway Club public running, 11am-4pm, Lodge Farm Park, Romford. RM2 5AD

26 Hereford SME public running, Broomy Hill, Hereford HR4 0LJ, <https://hsme.co.uk/> noon-4.30pm

26 High Wycombe ME public running, Watchet Lane, Holmer Green, High Wycombe, HP15 6UF, 11am-5pm

26 Lincoln & District ME running at car boot sale, North Scarle playing field, LN6 9ER

26 Worthing ME public running, Field Place, The Boulevard, Worthing BN13 1NP 2-5pm

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1 Hereford SME Summer steam-up/60th anniv, Broomy Hill, Hereford HR4 0LJ, hsme.co.uk/ noon-4.30pm

2 Tiverton & Dist MES running, Rackenford, EX16 8EF

2 Guildford ME Stoke Park Railway Gala, Stoke Pk, Guildford GU1 1TU, 10am-5pm

3 Rugby ME members running, Onley Lane, Rugby CV22 5QD,

8 Tiverton & Dist MES running, Rackenford, EX16 8EF

9 Rugby ME Narrow Gauge Weekend, Onley Lane, Rugby CV22 5QD

10 Cardiff ME open day, Heath Pk, Cardiff CF14 4AW

10 Havering Miniature Railway Club public running, 11am-4pm, Lodge Farm Park, Romford. RM2 5AD

10 Lincoln & District ME running at car boot sale, North Scarle playing field, LN6 9ER

10 Worthing ME public running, Field Place, The Boulevard, Worthing BN13 1NP 2-5pm

14 Worthing ME Club Meeting, Field Place, The Boulevard, Worthing BN13 1NP 7.30pm

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

17 Tiverton & Dist MES running, Rackenford, EX16 8EF

22 Guildford ME IMLEC loco efficiency competition, Stoke Pk, Guildford GU1 1TU, 10am-5pm

24 Havering Miniature Railway Club public running, 11am-4pm, Lodge Farm Park, Romford. RM2 5AD

24 Lincoln & District ME running at car boot sale, North Scarle playing field, LN6 9ER

24 Worthing ME public running, Field Place, The Boulevard, Worthing BN13 1NP 2-5pm

28 Worthing ME Club Meeting, Field Place, Worthing BN13 1NP 7.30pm

30 Cardiff ME Steam-up & family day, Heath Pk, Cardiff CF14 4AW

30 Romney Marsh ME running for New Romney Country Fayre, Rolfe Lane, New Romney, Kent

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

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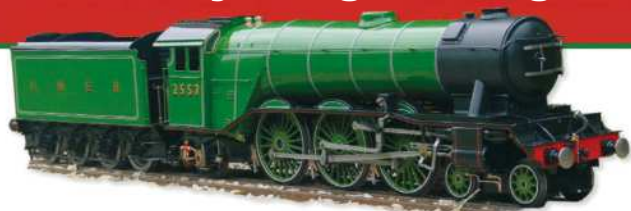
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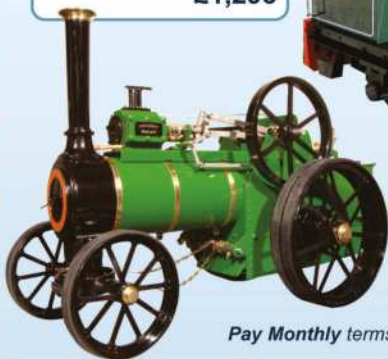


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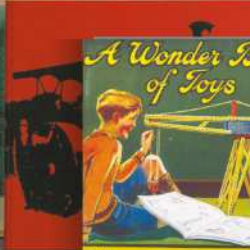
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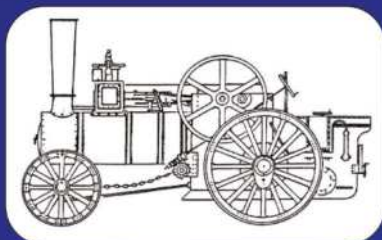
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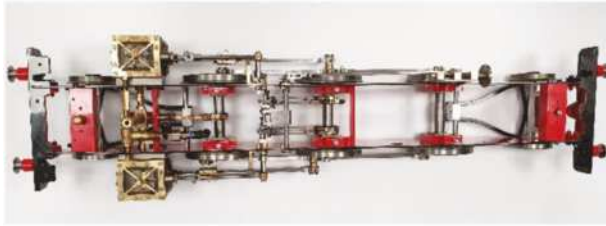
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