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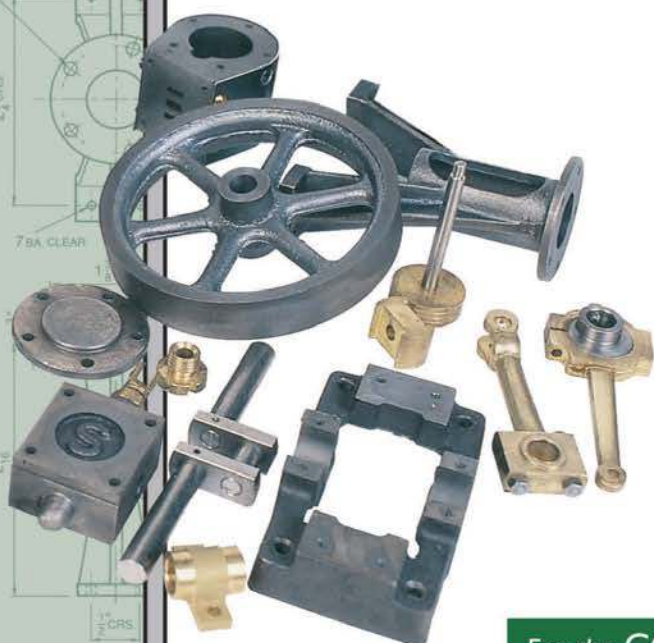
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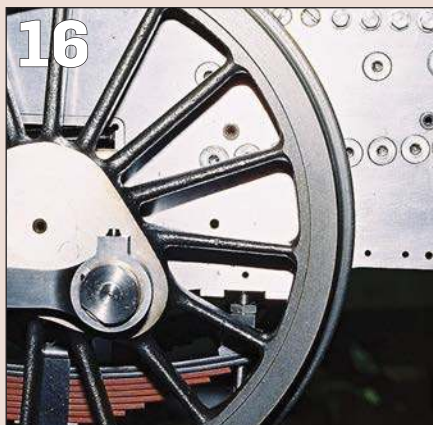
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FRONT COVER

This Decapod locomotive was the crowning achievement of the Finnish model engineer

Juhani Saloranta – a profile of his fine quality work begins on page 8.

Photo: Jan-Eric Nyström



EDITORIAL

See you in London for the first big show?

Welcome to the February edition of **EIM** – though I smile as I write this as it's actually New Year's Day! Hope you all had an enjoyable Christmas period and perhaps had some time for your model engineering projects.

As mentioned last month my pre-Christmas was enlivened by a visit to Taiwan, a most eye-opening experience though severely lacking in any model engineering content – it was all full-size narrow gauge and lots of it, a huge amount of redundant locos and rolling stock preserved in cosmetic form on the Far Eastern island. If you are interested I will be documenting the trip in the next issue of our sister magazine *Narrow Gauge World*.

Now, however, the focus is very much on the model side – this is the 12th issue I've overseen since taking over the editorial hot seat, and I am very much looking forward to attending the first big show of the year in London, the Alexandra Palace event taking place on 18th to 21st January just after this issue hits the streets.

I've attended several of the Ally Pally shows in the past and always enjoyed them, but when I went to last year's it was just two weeks after I took over the realms here – it was a big difference going from interested visitor to editor of the magazine that sponsors the show! Thankfully you model engineers are a friendly lot and both then and since I've made several new friends in the movement, and that makes going to the show this year something to look forward to even more.

We've got lots to tempt you in the coming year in these pages – since the last issue I've confirmed another major loco build series that will begin after we complete the current Dougal project. What the engine is? Well we'll tell you that soon... I'm also pleased that my recent appeal for more workshop features has produced a good response and some interesting features that I'm sure you will enjoy. But we always want more, so if you are planning to send in something, please don't hesitate!

Meanwhile I also intend to get along to the Manchester show, MMEX on 23rd-24th February. I haven't been to this one before though it's probably the closest to **EIM** Towers – do say hello if you see me there.

Andrew Charman – Editor

The March issue of **Engineering in Miniature** publishes on 21st February.

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Published monthly by Warners Group Publications Plc,
The Maltings, West Street, Bourne,
Lincolnshire PE10 9PH.

Articles: The Editor is pleased to consider contributions for publication in *Engineering in Miniature*. Please contact us to discuss your work.

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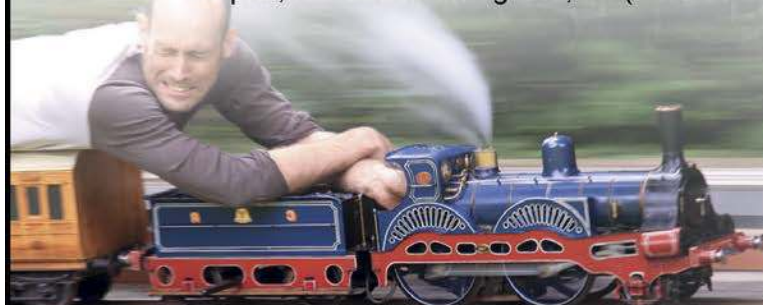
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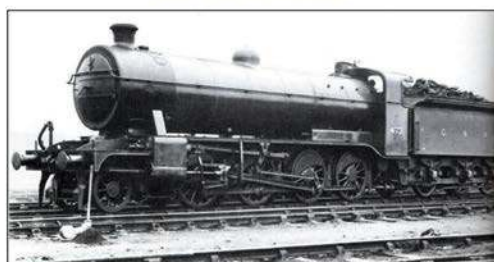
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The locomotives of Juhani Saloranta

Jan-Eric reveals the product of a talented Finnish engineer of miniature locomotives.

BY JAN-ERIC NYSTRÖM



Back in 1968, two members of the Miniature Railway Club of Helsinki, Finland, wanted to 'move up a step' from HO scale, to live steam. They decided to build two identical engines, using facilities at a vocational college to mill the wheels from solid steel stock.

One of the builders soon got bored with the huge amount of exacting work required, and instead started to restore a full-size narrow gauge engine at a museum. The other builder, Juhani Saloranta (1944–2012), persevered, continuing working on the engine in his home workshop for eight years.

PHOTO 1: Panoramic view of Saloranta's workshop. On the bench is an Emco mill and an Emco Compact 8 lathe. At left, his 'Decapod' 2-10-0 is under construction. At right is the inner firebox for the loco's steel boiler.

In 1976, he finished the miniature project, a 150mm (6-inch) gauge, 1:5 scale (2.4 inches to the foot) model of a domestic 'Tampella' narrow gauge 0-4-2 side tank steam locomotive, **Photo 2**. There are no cast parts in the entire locomotive, even the cylinders are fabricated from brass.

Back then, you could still buy 160mm diameter copper pipe, as well as 3mm thick copper plate in ordinary hardware stores – something which is virtually impossible today! Being readily available, this material was used for the boiler. The original boiler was riveted and silver soldered, but due to a lack of good information

available about the live steam hobby in general, and boiler building, silver soldering and pickling in particular (hardly any books on these subjects were available in Finland at that time), the boiler suffered from a few leaks in the firebox that proved to be impossible to fix. So, this boiler was scrapped and replaced with a three-flue steel boiler. This worked, but did not steam very well.

In the meantime, Saloranta decided to build a simple battery operated version of an Orenstein & Koppel type 0-4-0 Diesel, seen in **Photo 3**.

The photo shows the loco riding on an ingenious 'gauge adapter' that allowed Juhani to run all his 6-inch gauge engines on our railway museum's 7¼-inch gauge track! The adapter has flangeless rubber wheels which transfer the power and weight of the engine to the track, and separate, small flanged steel wheels that keep it aligned on the track.

It took Saloranta only about half a year to build the O&K. The driving force is a car windscreen wiper motor.

The next project was more challenging: a new live-steam loco, based on the well-known Orenstein & Koppel 0-4-0 well tank design, **Photos 4 and 5**. This engine is simply constructed, having a plate frame. The axle boxes reside in milled cut-outs in the frame and no horn blocks are used. Instead of springs, the axles are supported on rubber blocks, the



PHOTO 2:

First loco, a Finnish Tampella B1 0-4-2 ST. 150mm gauge, 1:5 scale, built in 1968-76.
Photo: Juhani Saloranta

PHOTO 3:

The second loco was this German Orenstein & Koppel 0-4-0 Diesel. 12 volt electric drive, 150mm gauge, 1:5 scale, built in 1983.

PHOTO 4:

The second steam loco, an Orenstein & Koppel 0-4-0WT. Copper boiler, 32 firetubes. 150mm gauge, 1:5 scale, built in 1986-87. This view shows Saloranta's own track, made by attaching 25 mm T-profile hot rolled iron to wooden ties.

PHOTO 5:

During a steam festival in Porvoo, Finland, Juhani Saloranta ran the engine on a temporary track nailed to the sleepers of full-size track.

PHOTO 6:

The Decapod's boiler during construction. The barrel is a piece of district heating pipe.

PHOTO 7:

The firebox is constructed of heavy steel plate, with welded crown reinforcement.



resilience of which provides enough flexibility. On the outside, these simplifications cannot be seen.

The cylinders and wheels are cast in 'grey' iron, while all other parts are fabricated. The valve gear is of the Bremme/Klug type, very similar to the Hackworth and Marshall-type gears. This engine has performed well for more than 20 years of service.

Better workshop

Already in 1977, Saloranta had started to build his own house, with an annex containing a genuine Finnish sauna and a workshop, the latter seen in **Photo 1**. The buildings were finished in 1981 and after his third engine was completed, he started on a much more ambitious project: a large, live-steam, 1:8 scale, 7¼-inch gauge, Baldwin 2-10-0 Decapod engine.

With only a few drawings and photos of the prototype, Saloranta had to design most of the parts from scratch, while keeping the 'looks' of the miniature as true to the original as possible, considering the functionality of the scaled-down parts. The steel boiler's barrel is made from a piece of district heating pipe, certified for pressure use, while the other boiler plates are just that – certified boiler plate! Safety first, always, in our hobby...

Photos 6 and 7 show the boiler under construction. It is designed for a working pressure of 6 bars. Due to the sturdy construction of the boiler, as well as the heavy frame and massive wheels, this miniature engine weighs about 300kg in operating condition, including the tender.

The boiler's firebox has a grate suitable for both wood and coal fuel,



the choice dependent on the expected load – for light running, a wood fire is sufficient, but for heavy hauling, coal or even anthracite may be used.

Firing up the boiler is very similar ▶





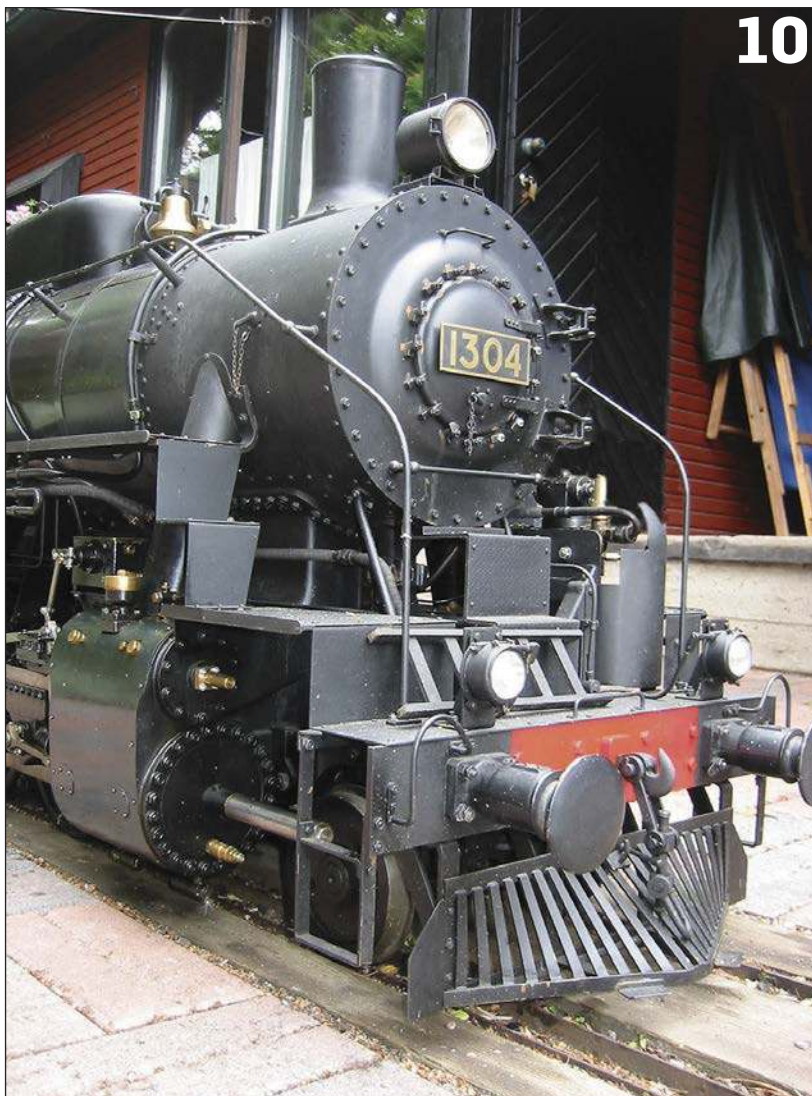
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9

BALDWIN 'RUSSIAN DECAPOD' 2-10-0

Scale: 1.5in/ft (1:8) Gauge: 7 $\frac{1}{4}$ in/184 mm
 Length over buffers: 2750 mm Width: 410 mm
 Weight, operational: 300kg
 Boiler pressure: 6 bar Steam superheater
 Cylinder diameter: 75mm
 Piston stroke: 90mm Piston valve diameter: 40mm
 Two injectors Axle pump
 Double-acting tender hand pump
 Steam operated drain cocks
 Walschaerts link motion Power reverser (compressed air)
 Wheels: 165mm (driving) 108mm (front)
 Middle driving wheel flangeless
 Axle lubrication by mechanical pump
 Rod bearings: grease lubricated
 Leaf springs & equalized suspension
 Steam powered air compressor
 Air brakes on all driving & tender wheels
 Steam powered stoker with 2 cylinder engine
 Turbo generator Headlight & loco running board lights
 Buffer beam lights on loco & tender



10

PHOTO 8:

Saloranta is here firing up his Decapod. Note the fan, to provide enough draft for firing.

PHOTO 9:

Birch bark is used as tinder.

PHOTO 10:

The Decapod is extremely detailed, as can be seen in this close-up front view.

All photos by Jan-Eric Nyström unless stated.

to full-size procedures: in order to get a fire started, you first need to provide some draft. An electric fan attached to the smokestack provides this, as seen in **Photo 8**. Then you need a fuel which burns easily – wood is suitable for this purpose, and some tinder is also necessary. In **Photo 9**, traditional Finnish tinder, birch bark, is used to start the fire. When the wood burns nicely, coal can be added on top of the fire. It can take up to two hours to get from cold to full pressure safely, without straining the boiler.

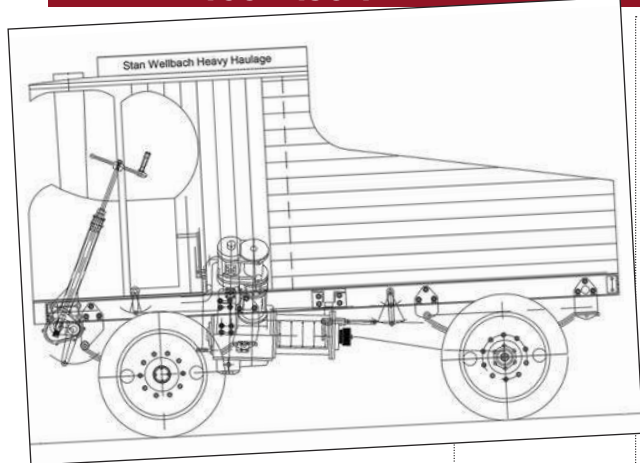
Lots of features

As seen in the specifications in the panel, and in **Photo 10**, this engine has an amazing amount of functional features, all based on the original prototype. In the next issue, we'll take a closer look at many of the incredible details that Saloranta has added to this magnificent live-steam engine, which took him some 14,000 hours during a period of 15 years to build. **EIM**

Building a large-scale Fowler Steam Lorry

Martin resumes his series describing the building of an unusual 7-inch scale project, this month focusing on construction of the wheels.

BY MARTIN JOHNSON



With a nearly viable engine completed, needing just lubricator pumps, it was time to move on to the wheels. This is an area that I have strong feelings about, and a pneumatic lorry wheel of the period should look something like the Sentinel front wheel in **Photo 1**.

The moulding in the tyre reveals it to be a 40 x 8 – that is 40-inch rolling diameter with a tyre 8 inches wide. Most modern tyres will be well over scale width, the tyres on my personal shopping trolley being 9 inches wide, before any scale factor is taken into account! But Ford Focus spacesaver tyres have reasonably similar proportions to these old tyres. Also, the Citroën 2CV has a strong owners' club, that will supply 16 x 135-75 tyres built to full road-use specification, (not the restricted speed, temporary use construction of spacesavers).

After scouring various scrapyards and buying every Ford Focus spacesaver wheel in the north of Scotland, I had seven of the items in **Photo 2**. But there was obviously a lot of work to do before these looked like the real thing.

First of all, the two 'scallop holes' were bored in using a 60mm hole-saw. **Photo 3** shows the rather 'interesting' set-up on the mill used for this operation. The backplate holding the wheel is a piece of 40mm kitchen worktop, which was machined to fit the wheel using the same setup. I also had to fit some radial screws which were used in the style of a four-jaw chuck to true up the wheel on the jig.

The 'scallop holes' would be used

PHOTO 1: Prototype Sentinel front wheel with its pneumatic tyre.

PHOTO 2: Starting point – Ford Focus spacesaver spare wheel.

PHOTO 3: Mill set-up for boring holes in wheel rim.

All photos and diagrams in this feature by Martin Johnson



to hold the wheel for subsequent operations, but I noticed that quite a lot of internal stress was relieved when the saw broke through and the whole wheel took on a slight 'saddle-back' form. In retrospect, it might have been better to carry out this operation later in the sequence.

Next, the centre was cut out by milling using the same set up as in **Photo 3**, then plain laser-cut centres from 4mm steel were welded in. Careful clamping was needed to prevent distortion during the welding operation – this is shown in **Photo 4**.

Normally, I would put a 30-degree weld preparation on each side, and a radial gap of 1-2mm for such a weld, ▶





PHOTO 4:
Rim carefully
clamped for
welding in
the centre.

PHOTO 5:
Finished rim.

PHOTO 6:
Set-up for
milling and
drilling inside.

PHOTO 7:
How internal
diameter was
measured.

PHOTO 8:
Jig for drilling
stud holes.

PHOTO 9:
Reaming stud
holes was a
challenge on
drill machine.

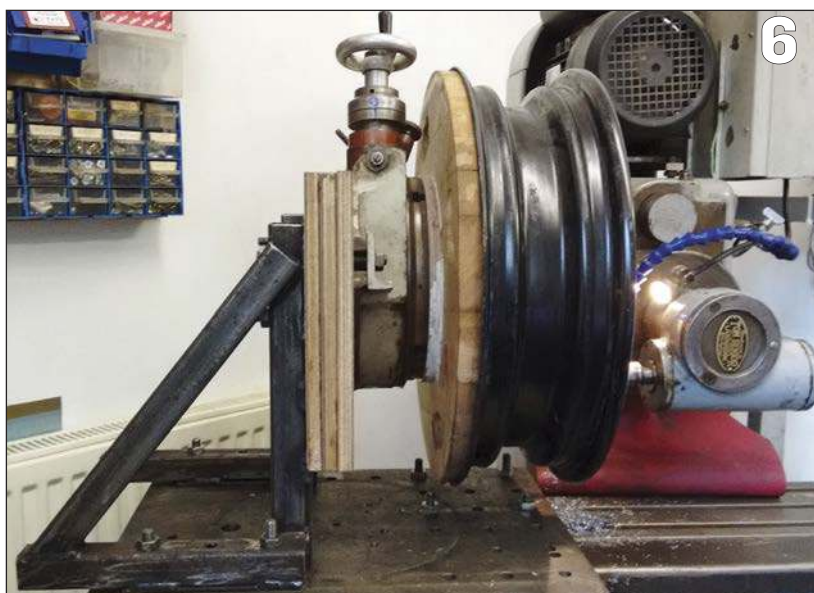
PHOTO 10:
Finished wheel
after painting.

PHOTO 11:
Original Fowler
engraving of
front-axle
arrangement.

FIGURE 1:
Braking needs
required new
axle design as
seen here.

PHOTO 12:
Castings for
brake drums.

PHOTO 13:
Machining a
datum face on
rear of hub.



but after some experimentation, I found that the radial gap needed to be much less, otherwise the welding tended to pull the new centre to one side resulting in an excessive gap further round the joint. This underlines the need to experiment on some scrap pieces for such jobs to get all the weld parameters right before you start.

Once the first side had been welded on the jig, the wheel was flipped over, the base of the weld 'veed' out with a cutting disc and then the second side welded. Finally, the

whole lot was fettled to produce the results in **Photo 5**. Remember that the scallop hole is used to access the tyre valve, so the new holes must align with the valve hole as shown at bottom left of the photo.

Next on the agenda was milling the inside diameter so that it sat snugly on the spigot of the wheel hub, and putting 10 holes through for wheel studs. But consider that there are seven wheels (two on the front axle, four on the back axle and a spare) and all must be interchangeable so the job is rather more complex than you might think.

The internal register diameter was milled in, since I don't have a lathe that will swing 17 inches diameter. The setup is shown in **Photo 6**. This setup is obviously rather flimsy, but with small cuts and a lot of patience it was eventually done.

The internal diameter is nominally 156mm and although I have a large vernier caliper to cover that size, using it is laborious so I made up a very crude comparator as shown in **Photo 7**. This was quite quick in use, and although it doesn't give an absolute reading, all seven wheels emerged at the same size within 0.1 mm.

While the wheels were set up to mill the internal bore, the 10 stud holes were drilled using the rotary table seen in **Photo 6**, and the digital readout on the mill to set the radius. Remember again, that the stud holes must be in a fixed relationship to the scallop holes, so that both scallops will line up on the twin rear wheels.

The set up shown in **Photo 6** was good enough for drilling the stud holes, but was certainly not a rock-solid arrangement; so I took the opportunity to use a jig, which I shall describe in detail with the axles, to ream the holes. **Photo 8** shows the jig in close up, complete with hardened drill bush, and **Photo 9** shows that the reaming operation was a challenge to get on the drilling machine.

Finally for the wheels, **Photo 10**





shows one of the front wheels after painting and temporarily assembled onto a hub; I think it is a reasonable representation of a real wheel – certainly better than the planted-on decorative cap one so often sees on steam miniatures.

Front axle assembly

The Fowler front axle is illustrated quite well in the firm's engraving, shown in **Photo 11**, which shows a view from the front offside of the vehicle. The stub axle has an integral king pin, extending up into bearing bushes housed in the axle beam, which makes the assembly quite tall with the leaf spring being well above the axis of the wheel.

Such an arrangement is fine when brakes are only fitted on the rear axle; however if brakes are fitted to such a front axle the braking force tends to fold the wheels underneath the spring and places excessive stress on the springs. That is why a 'swan neck' front axle is needed with braked front wheels so that the springs pass nearly through the wheel axis.

So a completely new design of front axle was needed which I based on a pair of stub axles from a dumper truck and a bit of inspiration from the



Sentinel S-series steam waggon. I also needed to consider what brakes to use and these needed to be drum brakes compatible with the pitch circle diameter of the 10 wheel studs. This dictates a brake drum diameter of around 10 inches and a bit of internet exploring showed that the early Volkswagen Beetles were fitted with 10-inch drum brakes. Better still, there is a healthy enthusiast market in spares for such brakes and front backplate assemblies frequently come up for sale as owners upgrade to front disc brakes. Armed with that information, it was off to produce some CAD and **Figure 1** shows the results.

I investigated whether the brake drum/hub could be adapted from a VW part, but could not work out a way to do it. So a bit more pattern making and some castings were needed to start with. The castings are shown in **Photo 12**, showing four brake drums and two drive flanges (for the back axle). The brake drum castings are just under 11-inch diameter, and my lathe has an 11-inch swing, so holding the brake drums in a four-jaw chuck over the outside is not an option. Photo 12 also shows a machining fixture (visible top right). This fixture was used to hold the brake drums during machining and also as a drilling jig.

The first operation on the brake drums was reasonably simple, ▶

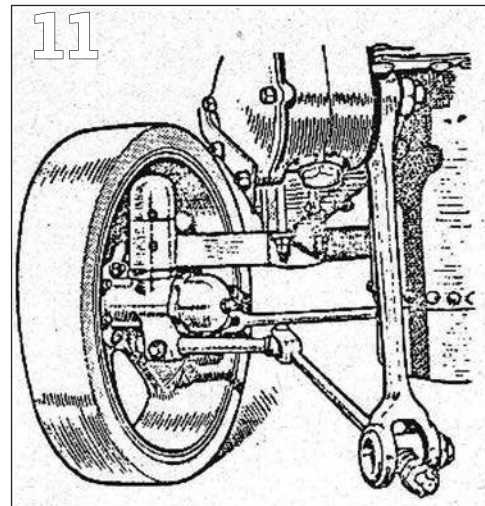
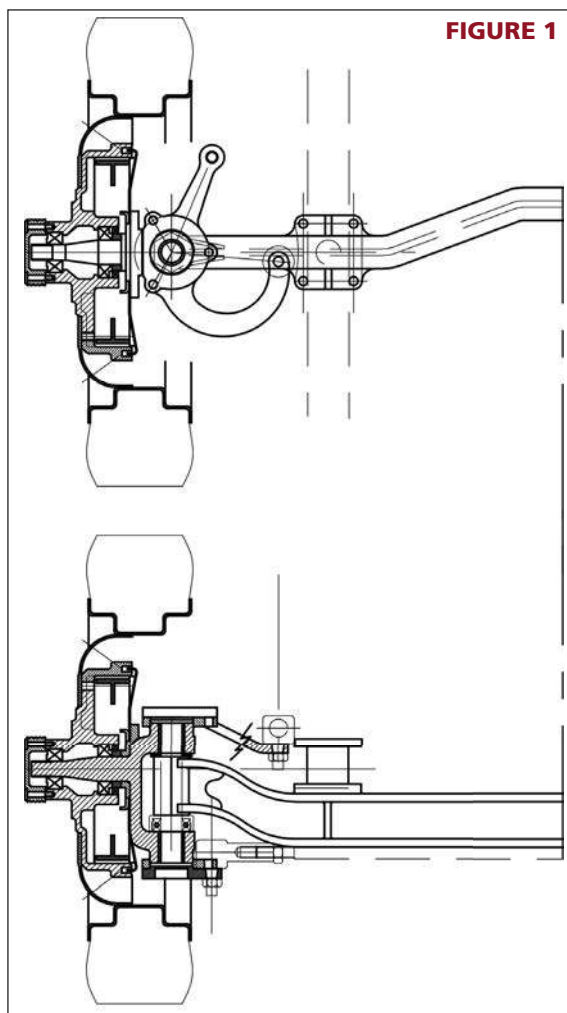


FIGURE 1





14

gripping to the four-jaw chuck on the inside (braking surface) to machine the front faces, wheel spigots and bearing bore. **Photo 13** illustrates a useful tool to have for such parts, allowing a datum face to be machined at the back of a part, which is a useful reference face when it is mounted for subsequent operations.

Next, the machining fixture is needed, and this was machined in the four-jaw chuck for the first side. A locating plug is also needed so that the jig can be mounted true on either the rotary table or lathe. The jig and plug are shown in **Photo 14**, which also shows the holes which have been drilled using the rotary table on the mill. The smaller diameter shown is the wheel bore diameter, so that this side can be used as a jig to ream the wheel stud holes. The six-hole pitch circle will allow the jig to be bolted to the lathe faceplate.

The jig can also be mounted on the lathe faceplate as shown in **Photo 15** where a register is machined to take the wheel spigot on the brake drum; hence the drum can be machined both sides with concentricity assured. The brake drum is bolted to the jig (heads facing away from the photographer) with M8 bolts, the threads being drilled out for fitting the wheel studs. The rigidity of the set-up was exceptional. Incidentally, when I

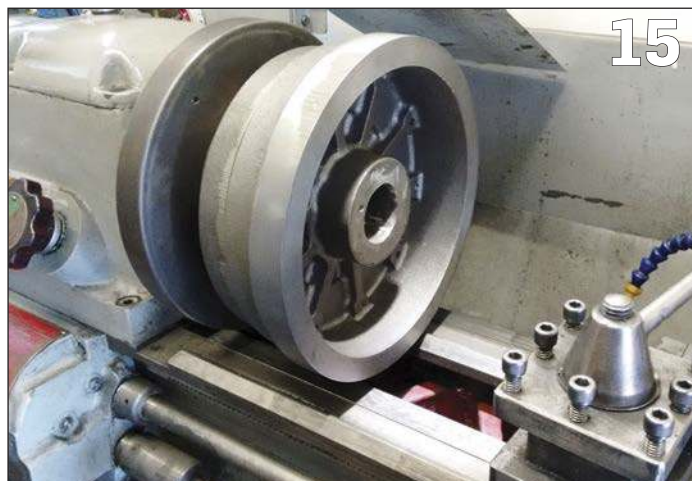
purchased my lathe it was without a faceplate, so I made a pattern and got one cast **without slots**; the slots never seem to be in the right place, so I just drill and tap wherever I need a stud. Some 25 years on, and I think the faceplate will last me out before I need to cast another.

So, after creating quite a lot of cast iron swarf, I had all four brake drums machined. The castings are identical for front and back axles, although the machining is different but it was convenient to do the four as a batch.

Front axles

Photo 16 shows the stub axles as retrieved from the dumper truck. Dumper trucks are rear-wheel steer, so the steering geometry was all wrong for a front-wheel steer vehicle of longer wheelbase so the Ackerman steering arms were cut off (see bottom left of the photo for the evidence). Dumper trucks don't have brakes on the rear axle either, and I found that both axles were bent and both had damage where the bearing races had rotated. Consequently, there is a lot of modification work to do – in fact it may well have been quicker to make a pattern and to get malleable iron castings done.

Photo 17 shows how flanges for the brakes were added, the addition being a machined flame-cut blank.



15

This is fitted at a rather jaunty angle so that the brake pipes can get a reasonable run and the brake adjuster can be accessed. Note that a steel block has been temporarily welded to the axles to allow them to be held in a four-jaw chuck for machining.

Next, flanges were added to the top and bottom of each stub axle to take the steering arm, Ackerman arms and a blanking plate respectively. **Photo 18** shows a view of the stub axles as seen looking toward the front of the vehicle; laser-cut flanges have been welded on to the stub axle castings (they are steel castings), and laser-cut Ackerman arms, steering arm and blanking plate will be fixed by fitted bolts.

Doing things this way allows the accuracy of the laser-cut process to be exploited to ensure accurate steering geometry, while all I had to do was line up the flat face of the laser-cut blank with the machined face of the stub axle. The steering geometry was designed by referring to my trusty copy of *The Elements of Motor Vehicle Design* by C. T. B. Donkin, first published in 1926 – contemporary with the vehicle I am modelling.

The axle beam is made up of three laser-cut sections making the web and top and bottom flanges of an I-section. Since the axle is a swan-neck design as previously outlined and also has to dodge round the back of the boiler,

PHOTO 14:

Jig and plug for true mounting of part on rotary table or lathe.

PHOTO 15:

Jig mounted on lathe faceplate

PHOTO 16:

Basic stub axles sourced from a dumper truck.

PHOTO 17:

Machined and flame-cut blank provides brake flanges.



16



17



there is quite a lot of bending to do on the blanks. **Photo 19** shows a typical bend in progress; note that the blanks can be tack welded to suitable formers, bent and re-bent as often as needed. The heating nozzle of the oxy-propane cutting torch is a great help in these operations but disable the cutting gas supply just in case your work disappears in a shower of sparks – you will see the cutting lever on the torch has been flipped over in the photo.

I include **Photo 20** of the axle at tack-up stage to emphasise that in this type of operation, there will be a lot of tack welding and then breaking apart again for more adjustments before everything is as you want it to be. The three-dimensional shape of the axle is clear. For reference the top and bottom webs are 10mm plate.

The king pins and their housing were rescued from the dumper in reasonably good condition, but I decided to include a ball-thrust bearing to take the weight of the vehicle front end (which is estimated to be about 800kg) in order to make steering easier.

The housing needs to be fixed to the axle at the required castor angle, so that the steering 'self corrects'. **Photo 21** shows these locations being machined in as a boring operation. The axle is held at the required angle by temporary packings which were

welded onto the axle and then machined to the required angle. Fortunately, as the stub axles were at right angles to the king-pin axis, there was no camber angle to worry about for the king-pin axis. For the curious, the axle beam missed the workshop radiator – but only just!

Once the locations for the king housings had been machined to the correct angle, welding on the housings was a simple job. There was a little bit of scraping needed in the king-pin bore to correct welding distortion but that was it. I was lucky to find new brake reconditioning kits on eBay at a very good price, and painting and building proceeded without undue

incident to achieve the result shown in **Photo 22**. I made a mistake in not having the track rod and ball joints ready to fit and the resulting assembly was very tricky to manoeuvre around the yard. The ball joints are from a Skoda Octavia (Ebay again) and the track rod is home made. **EIM**

■ Parts 1 and 2 of this project appeared in the September and October 2018 editions of **EIM** and we will continue the build next month – . You can also follow construction of the chassis online at: www.flickr.com/photos/140734312@N06/sets/72157669955074511. The author can also be contacted via the editor.

PHOTO 18:

Made-up stub axles, looking towards front of vehicle.

PHOTO 19:

Bending axle beam to shape.

PHOTO 20:

Lots of tack welding was needed in axle construction.

PHOTO 21:

Set-up for machining the axle mounts with correct castor angle.

PHOTO 22:

Job done – the completed front axle sub assembly with the springs mounted to it.



Locating parts with dowels

John continues his series of best practice techniques by revealing the uses for the dowel pin – another less than widely-known workshop aid.

BY JOHN SMITH

Dowel pins (**Photo 1**) are steel pins which are precision-ground to narrow limits, used for the precise location and alignment of parts in jigs, fixtures and high-quality machinery. Once inserted, the tightness of fit keeps them in place.

As an example, the jig shown towards the rear of **Photo 2** is a locomotive wheel quartering jig which was subsequently adapted (without destroying its primary purpose) as a pair of trunnions to support yet another radius turning attachment.



PHOTO 1:
A selection of dowel pins in various sizes.

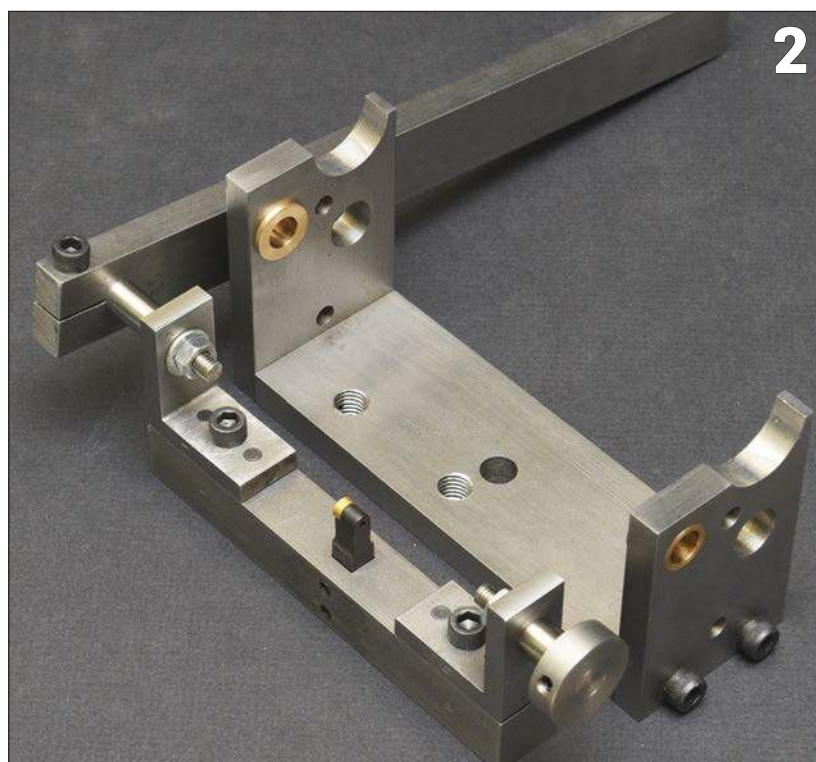


PHOTO 2:
Jig made for loco wheel quartering, adapted for a different purpose using dowel pins.

PHOTO 3:
Dowels can be used with screws to ensure no loosening of bolted parts under repeated stresses, such as here.

PHOTO 4:
Extractable dowels, useful if parts need to be disconnected.

All photos by John Smith

This attachment is shown in the foreground of **Photo 2**.

The quartering jig features two 1/4-inch diameter dowels at each end, outboard of the M6 Allen screws. This jig can be disassembled and reassembled, and the screws can work loose, but the dowel pins maintain the precise alignment of the two ends. The 3/16-inch diameter dowel pins positioning the trunnions of the radius turning attachment are clearly visible.

Dowels for all

Dowel pins are manufactured to a variety of standards, including:

BS 1804 – Pins with one chamfered end and one domed end, available in Imperial and metric sizes in silver steel, hardened steel, and austenitic stainless steels 304 (A2) and 316 (A4)

DIN 6325 – Pins with one chamfered end and one domed end, available in through-hardened 100Cr6 tool steel, case-hardened mild steel, 304 (A2), and 316 (A4)

ISO 8734 – Pins chamfered at both ends, available in martensitic stainless steel C1, case-hardened steel, and in 304 (A2), and 316 (A4)

ISO 8735 and **DIN 7979** – Extractable dowel pins with a threaded hole at one end, available in martensitic stainless steel C1, through-hardened 100Cr6, case-hardened steel, and in 304 (A2) and 316 (A4)

ISO 2338 and **DIN 7** – General-purpose dowel pins available in mild steel, 304 (A2) and 316 (A4)

Dowel pins are also available to ANSI standards. This all sounds very complicated, but the fact is that, with the exception of those specifically made and sold as nominal size pins with minus tolerances, dowel pins are all manufactured to be very slightly over nominal size to provide a 'transition fit' in a reamed hole. This ranges from a tight sliding fit to a light press fit.

Metric pins and some Imperial pins are made to the ISO m6 tolerance. This means that the diameter of a 6mm pin will be between 6.004mm and 6.012mm, in other words between 0.00015-inch and 0.00047-inch over nominal size, so – given a bag of pins – we can select a dowel to suit the type of fit we want.

Dowels for screws

Most model locomotive designs do not

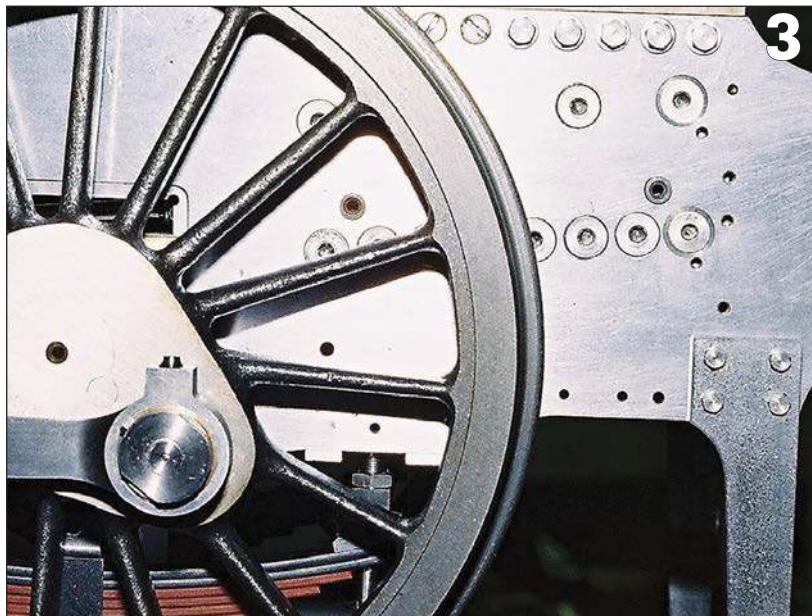
specify the use of dowels, for example relying on the screws attaching weigh-shaft and brake-shaft bearings to main frames to provide a 'good enough' location. However, there are three places on a model locomotive where screws are not good enough. These are the joint between a connecting rod and the big end strap, the location of the motion plate within the frames, and the attachment of the cylinders to the frames.

All these are subject to continuous 'hammer blows' when the loco is running. This can cause screws to become loose and threads to 'fret'. Two dowels locating each cylinder to its main frame (**Photo 3**) and each end of the motion plate to its frame will keep everything tight. Use extractable dowels (**Photo 4**) to allow the cylinders and motion plate to be dropped without the need to disassemble the frames. For the big end, use taper pins (arguably a form of dowel) threaded at the narrow end to keep the pin tight.

I would also install dowels (after assembly) to positively fix each web-axle and web-crankpin joint in a built-up crankshaft assembled using Loctite. This provides a high-quality, 'belt and braces' component.

When fitting a dowel pin into a blind hole, always grind a small flat along the length of the dowel to allow air to escape. This will prevent the excessive pressure behind the pin from either forcing the pin out or damaging the workpiece.

"Hammer blows' when the loco is running can cause screws to become loose and threads to 'fret' – dowels will keep everything tight..."



START HERE

From push-pull to rotate...

Latest in our beginners series unlocking the mysteries of steam locomotives.

Short and simple this month, identifying the most basic parts of the motion, for transferring the push-pull action of the piston in the cylinder to the rotary motion of the wheel to move the locomotive. No matter which of the several types of valve gear that are employed this part is basically the same to all.

The front end of the **piston rod** has the piston mounted on it, running in the cylinder, and the other joined to a normally H-shaped plate – the **crosshead**. This slides between guides, usually two (but sometimes one) mounted above and below the rear of the cylinder, and known as **slide bars**.

From the crosshead a long steel rod, the **connecting rod**, leads to the driving wheels – usually the rearmost on an 0-4-0 locomotive, but on locos with six main driving wheels or more, typically (but not exclusively) either

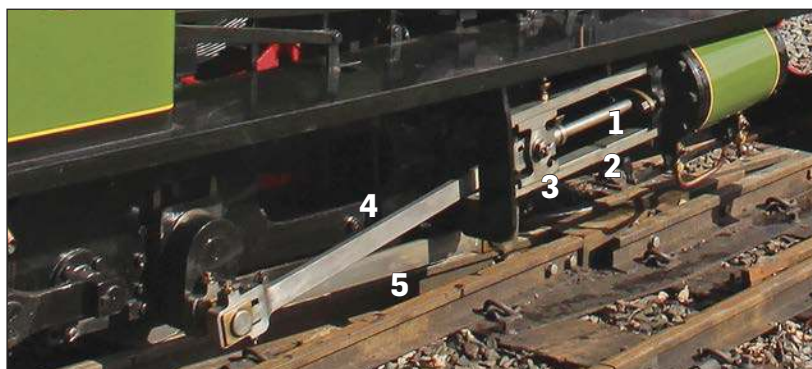
RIGHT: This narrow gauge quarry Hunslet locomotive is fitted with Stephenson's link motion, simple to look at on the outside with only the piston rod (1), slide bars (2), crosshead (3) connecting rod (4) and behind it the coupling rod (5) visible on the exterior. Photo: Andrew Charman

the centre, or in the case of locos of eight driving wheels, either of the centre pair of wheels. All the driving wheels are connected by another rod, the **coupling rod**, from where we get the expression four-coupled, six-coupled loco and the like from.

The connecting rod pushes on the rim of the wheel, transforming

forward and aft motion into circular motion, and the coupling rod transfers this motion to the other wheels.

The motion on the left and right-side of the locomotive are set up quarter of a turn apart ('quartering') to avoid locking up – one side will effectively always be pushing while the other is pulling. **EIM**



Dougal – a 5-inch Barclay

Young Sussex engineer Andrew completes the final motion components on his entry-level locomotive construction project.

BY ANDREW STRONGITHARM – Part Ten of a series

The final motion components to manufacture were the two crossheads which transfer the forward and backward motion of the pistons to the connecting rods. These started life as two pieces of 1½-inch x 1¾-inch x ⅝-inch bright mild steel. The sharper-eyed amongst you will notice that I did not allow provision for the piston rod guide as this was made from round material and was silver soldered in separately at the end.

The basic shape was machined into both pieces first and to help simplify the manufacture I machined all the sides square as opposed to containing a corner radius which the drawings show. A ⅜-inch diameter x ¼-inch deep counterbore was drilled into the front face of each crosshead

ready to locate the piston rod guide later on.

To prevent the slide bars and crossheads from wearing when in service, I machined a slightly deeper slot in the top of the crossheads for a pair of 30swg bronze slippers. These would be fitted either side of the slide bars with the intention that they will wear out quicker and are easier to replace. Using a ⅜-inch end mill, I machined the slot in the top of the crossheads to a depth of 0.452-inch; this allowed room for the bottom 15 thou slipper.

The crossheads were then thinned down by ⅛-inch either side (the drawings don't give a dimension for this) and a step was machined at both ends of the slot for the slide bar to



The prototype 'Dougal' loco is a 2ft 6in gauge Barclay 0-4-0 built in 1946 for the Provan Gasworks in Glasgow and today resident on the Welshpool & Llanfair Light Railway in mid Wales.

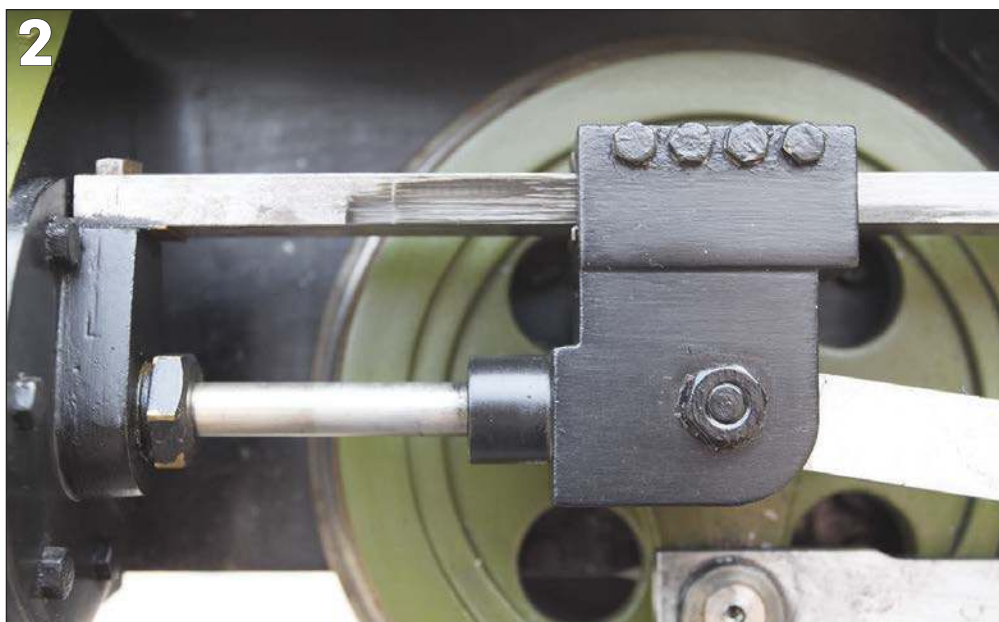
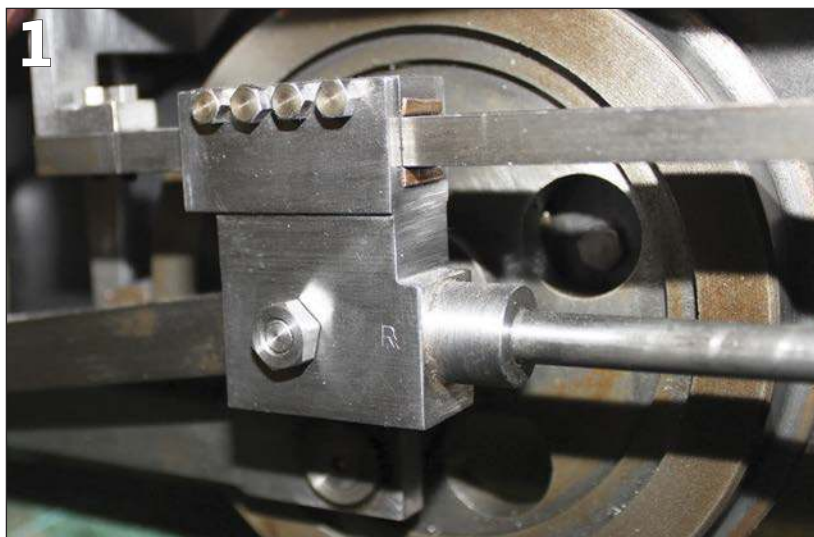
distinguish the connecting rod cut out which was next to be machined. This was a ¼-inch wide slot that the connecting rod fits into and is securely held in position by the gudgeon (or crosshead) pin. It is important that this slot extends to the dimensions shown on the drawings as the connecting rod needs to be able to pivot in the slot and could jam if the slot is not the correct size.

Next, I held the crossheads one at a time on their sides, set up off the base of the vice on a pair of parallels resting on the bottom half of the crosshead. Care had to be taken to ensure they were level as the width at the top of the crosshead is greater where the slide bar fits.

Using the edge finding technique which I described in a previous article, I pitched across to the location of the hole for the gudgeon pin and drilled this out using a 6.2mm drill. After reducing the RPM of the milling machine down to just below 100, I reamed this hole out using a ¼-inch machine reamer.

Design change

Before moving on to drilling the holes along the top of the crosshead, I swapped the reamer for a 10mm diameter 90-degree countersink and proceeded to insert a ⅜-inch wide countersink around the hole which I had just drilled. The size of the countersink is very important as, in a change to the published design, I made the gudgeon pins with a countersunk head which would locate and hopefully lock in the corresponding countersink in the crossheads. This also meant that the head of the gudgeon pin would be flat against the back of the crosshead. Naturally the countersink must be inserted on opposite sides of both crossheads as this now distinguishes



which crosshead will become the left or right-hand side.

In order to make the slide bar clamping plates removable I chose not to use the iron rivets as shown on the drawings and instead used custom-made 7BA fitted bolts. With the crossheads still held flat in the mill vice after drilling the holes for the gudgeon pins, I drilled a row of four holes at $\frac{1}{4}$ -inch spacing $\frac{3}{32}$ inches in from the top of the crosshead. These were initially drilled out 2mm through both sides of the slide bar channel before the outside face was opened out afterwards to 2.5mm which is a tight clearance size for 7BA.

Since these fitted bolts would be subject to moderate force whilst the locomotive is in motion, I chose to use a clearance-sized drill which was 0.1mm below the normal recommended size. Likewise whilst making other critical components some tapping-size drills were also deliberately selected 0.1mm undersize to ensure that the threads were as strong as possible and had the maximum possible engagement. I could now use the clearance holes as a guide to run a 7BA tap through in order to only thread the back face of the crossheads.

Plates and bolts

The clamping plates themselves were made from two pieces of $\frac{3}{8}$ -inch x $\frac{1}{4}$ -inch gauge plate, which was left over from making the slide bars. Although this meant that I had to reduce the thickness, it did mean that they were exactly $\frac{3}{8}$ -inch wide and already a tight fit in the top of the crossheads.

I reduced the thickness by 77 thou to account for the second bronze slipper which was fitted above the slide bars. Each one was $1\frac{1}{4}$ -inch long and by holding them lengthways across their top and bottom face, I was able to drill the row of four holes which matched those already drilled in the crossheads. These were drilled out 2.5mm and once de-burred were ready to be trial assembled in the top of the crossheads together with the custom made 7BA bolts.

The bolts were made from $\frac{5}{32}$ -inch stainless hexagon and a length of $\frac{5}{8}$ -inch was turned down to 2.5mm before a 7BA thread was cut on the end $\frac{1}{8}$ -inch of each bolt. By making the bolts in this way, it means that their ends finish flush with the back of the crossheads which is important due to the lack of clearance against the coupling rods.

As mentioned earlier I made the piston rod guide, which is threaded internally to hold the piston rod, separately from the rest of the crosshead and silver soldered it into

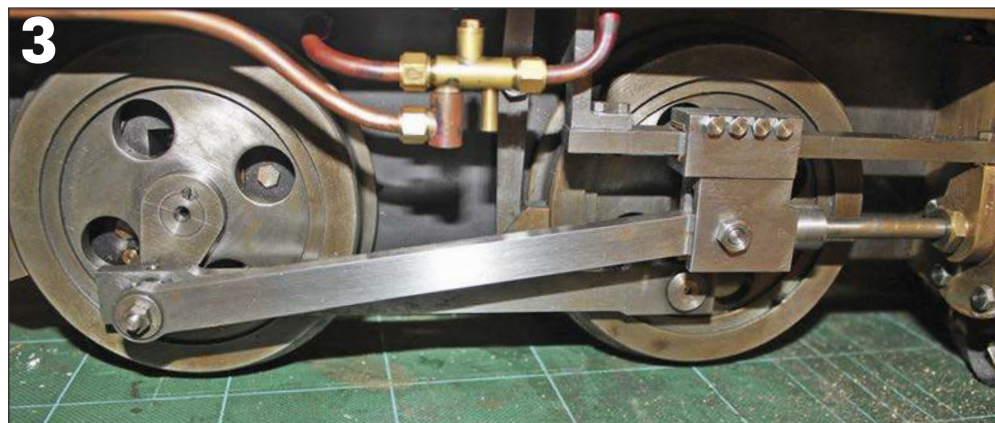


PHOTO 1 & 2: Completed crosshead and piston rod assembly.

PHOTO 3: Complete external motion after assembly..

PHOTO 4: An earlier view before the crossheads and guides were fitted.

All photos in this feature by Andrew Strongitharm

the front of each one. These were made from $\frac{1}{2}$ -inch diameter bright mild steel and I turned one end down to match the dimensions of the locating holes which had been previously drilled into the front of the crossheads.

These locating spigots were a slide fit into the holes and made the job of holding them steady during the soldering process very easy. Each spigot was drilled and threaded $\frac{1}{4}$ -inch x 40tpi to accept the piston rods prior to soldering so all I had to do once they were fitted was to clean the threads out with a plug tap (**Photos 1 and 2**)

The final two parts of the motion left to make were the pair of gudgeon pins that hold the little end of the connecting rods to the crossheads. My design was made out of $\frac{3}{8}$ -inch diameter silver steel which I began to manufacture by turning a $\frac{3}{4}$ -inch length very carefully and accurately to a diameter of $\frac{1}{4}$ -inch. This must be a good fit through the crossheads as a poor fit will mean there is unnecessary movement built into the motion before the locomotive is finished.

I turned the end $\frac{1}{4}$ -inch down to .0185 thou, threaded this 2BA and then using a 40 thou parting off tool undercut the base of the newly cut

threads to allow the locking nut to tighten up fully against the body of the gudgeon pin.

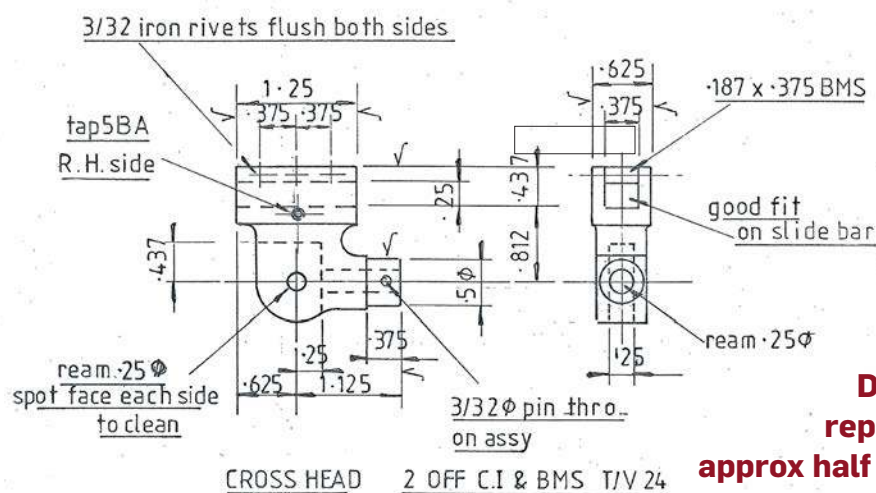
Next I spent a few minutes setting up a 45 degree turning tool in the lathe to turn the head of the pins which would fit inside the countersink in the back of the crossheads. The angles in both halves must be the same otherwise the pins will not lock in the countersink when they are fitted. Finally, I parted off each pin ensuring that I was left with a sharp edge on the tapered head.

Motion assembly

I could now begin the task of assembling the completed motion and work towards running the finished chassis on compressed air. The port & saddle block was fitted first and I made sure that the counterbored holes which accept the main steam pipes had the O-rings inserted prior to bolting the block between the frames. The cylinders could then be bolted onto the outside of the frames using the threaded holes in the bottom of the port & saddle block to secure them. The main steam pipes, which were screwed and sealed into the back face of the cylinders earlier in the build, were gently pushed through the ►



DRAWING 1



Drawings reproduced approx half full-size for 5-inch gauge

O-rings in the port & saddle block as each cylinder was offered up and bolted to the frames.

With both cylinders now fitted to the chassis, I could bolt the rear cylinder covers on together with both motion brackets. The slide bars are held between these components and they were duly fitted together with a

thin piece of shim placed on top of the cylinder cover to raise the slide bars up. It should be noted however that this is specific to the individual locomotive as my slide bars did not sit quite level.

It was now time to fit the crossheads and a further two pieces of bronze shim were cut up to insert either side of the top of the crosshead. I made the slippers slightly longer than they needed to be and bent the ends over to hold them in place. The combination of the shim together with the slide bar made them a very tight fit in the top of the crossheads. Once the clamping plates were bolted in place and even after the application of some lubricating oil, the crossheads were still very stiff to push along the slide bars. This was nothing to worry about as they would quickly 'run in' during the valve setting process.

(Photo 3, 4 and 5)

The drawings show that the piston rods are fixed into the crossheads with a couple of $\frac{3}{32}$ -inch pins, which are designed to lock them in position and prevent them from coming loose when in service. As I had made the decision to thread the piston rods into

the crossheads, I found that they could be wound up tightly against the end of the threads on the piston rods and this meant that they would not need to be pinned.

In order to calculate how far the piston rods are screwed into the crossheads, I first had to finish assembling the motion on the outside of the frames. I therefore fitted both connecting rods, which involved making a couple of steel washers to space them apart from the coupling rods on the crank pins.

The gudgeon pins were also inserted through the crossheads from the back to hold the little end of the connecting rods in place. However there is limited room between the crossheads and the front wheels to do this. I then fitted the custom-made nuts to the gudgeon pins, however I found it difficult to stop the pins from turning whilst I wound the nuts up. I can only assume that the two corresponding tapers were not quite the same and therefore did not lock together as planned.

Setting the motion

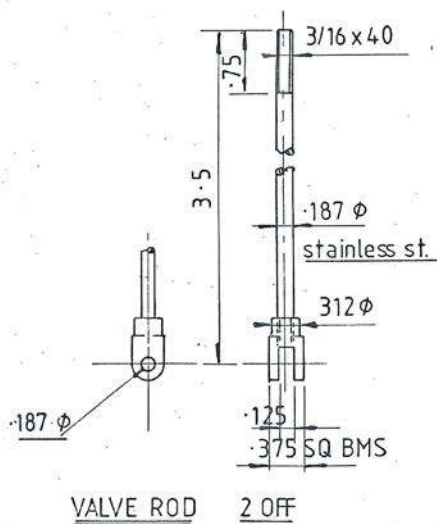
The next task was to centralise the pistons and this was easiest to do with the chassis jacked up in the air and with small pieces of $\frac{1}{8}$ -inch steel plate pushed underneath the axle boxes. Then using a scribe I marked a vertical datum line on the outside of both frames on the centre line of the front axle.

Starting with the left-hand side of the locomotive, I turned the wheels at least one whole turn in the forward direction until the crank pins were at the front (in other words at 9 o'clock as you look at them). You will know when you have reached this position as the locomotive will appear to feel slack. Having found that position, I placed a small scribe line on the front wheel in line with the mark which was already scribed on the frame.

I then repeated this process for reverse gear, having ensured that I had rotated the wheels at least a whole turn backwards to take out any back lash. Another scribe line was then made on the same wheel – if there is a difference the centre of these two lines is considered front dead centre. The right-hand side of the locomotive was then treated the same and once this was complete I could start to fit the pistons.

For this task I needed to know a number of key dimensions – the depth of the cylinder bores minus the locating steps on the cylinder covers, the piston travel and piston head thickness. The resulting dimension is then divided in half to calculate the depth that the front of the piston head should be from the front of the

DRAWING 2



DRAWING 1: Crosshead assembly.

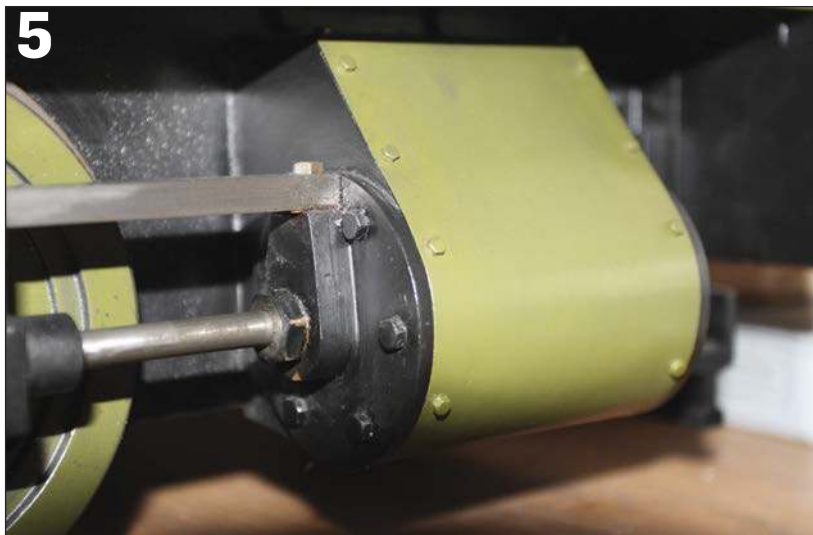
DRAWING 2: Valve rod – this drawing was missed from the September 2018 issue in which construction of the rods was described.

PHOTO 5:

Cylinder end of the piston rod guide.

PHOTO 6:

T-key made up to screw in piston heads onto rods.



cylinder block when the locomotive is at front dead centre. With the piston heads fully assembled onto the piston rods, I used the aforementioned key holes (see last month's article) to screw the piston rod into the crosshead. To complete this task a special T-key was fabricated with two steel pegs at exactly the same PCD (pitch circle diameter) as the holes in the piston heads. (Photo 6)

I was now able to screw the piston rods into the crossheads right to the end of the threads which I had initially cut on them. At this stage I had not fitted the O-rings to the outside of the pistons. I then rotated the wheels in the forward direction again until the front dead centre scribe lines matched up and using a depth micrometer I measured the distance of the pistons to the front face of the cylinders. I already knew what this dimension should be and I was therefore able to calculate how much further I needed to screw the pistons in by and how many extra turns need to be cut on the $\frac{1}{4}$ x 40tpi threaded piston rods. Once I was happy with the piston position within the cylinders, I could seal and fit the front cylinder covers with Loctite 574.

Steam chest fitting

Next, I turned the chassis over and fitted the steam chest to the underside of the port & saddle block, being careful not to scratch the surface-ground port face. This was much easier said than done as I had to fit the O-ring cord into its groove on the top face whilst at the same time pushing the bolts through without dislodging it.

With the steam chest now bolted down but importantly without the cover fitted, I could install the two valves, valve rods, eccentric rods and straps. These parts had all been trial fitted earlier, so I knew that there wouldn't be any unexpected issues. As described earlier in the construction series the nuts at either end of the valves must lock up on the valve rods but crucially must not clamp against the valves so that they are able to move vertically on the valve rod – I would recommend leaving no more than a couple of thou end-to-end.

With these components all assembled I could now rotate the wheels by hand and watch the valves move up and down within the steam chest. I adjusted the number of turns that the valve rods were screwed into the valve rod fork ends to ensure that the valves moved centrally within the steam chest and didn't over travel and hit the ends of the steam chest casting.

I could now fit the steam chest cover which also involved fitting the second piece of O-ring cord into the bottom of the steam chest. This meant that I had to remove all the bolts currently holding the steam chest down, fit the O-ring cord and place the cover on all without disturbing the loose casting. This was a minor price to pay for the time that the O-ring cord was about to save me.

The final jobs left to do were to blank off the oil inlet in the steam chest cover and make up a suitable fitting to screw the air hose into. The chassis was now mechanically complete so I dug out the air compressor and it was time for the moment of truth... **EIM**



Drawings in this series reproduced with kind permission of A J Reeves. Drawings, castings and material for this build project are available from A J Reeves.



Tel: 01827 830894 E-mail: Sales@ajreeves.com
Web: www.ajreeves.com

Previous Episodes of the build...

Introducing Dougal, April 2018; Building the boiler, May 2018; Frames, axleboxes, June 2018; Wheels, eccentrics, July 2018; Rods, boiler saddle, August 2018; Machining the steam chest, September 2018; Adding the eccentrics, November 2018; Machining cylinders, December 2018; Cylinder covers & slide bars, January 2019

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Next Month...

"A mixture of washing up liquid and water works well if applied with a paint brush around all the parts where you would potentially expect air (or steam) to escape..." Andrew prepares for a motion test.

When building a model of a full-size locomotive one can never see too many pictures of the prototype, so here are a quartet of the real 'Dougal' at home on the Welshpool & Llanfair Light Railway. As this is written the loco is proving a big hit, starring in a festival on the other side of the world in Taiwan.



Gas-fired vertical boiler for the EIM Steam Plant

Martin makes the final boiler components for the EIM Steam Plant beginners project.

BY MARTIN GEARING - Part 5 of a series

Stays & nuts

Lower Stay Nuts – 1/4-inch diameter, PB102. Refer to [Drawing B7](#).

Hold the 1/4-inch diameter rod with 15mm protruding from a self-centring or collet chuck. Face off, centre drill using a centre drill with a pilot of 2.5mm diameter or less. Drill 2.6 diameter x 6mm deep. Tap M3.

File the groove across the threaded face of the nut as drawn, using a second-cut triangular needle file. This groove will allow the silver solder to flow around the stay and through the tubeplate to form a fillet around the nut on the other side, securing and sealing the stay. Part off 9mm long. Try not to lose nut in the swarf! Repeat for the remaining two nuts. Put to one side.

Inner Stay Nuts – 1/4-inch diameter, PB102. Refer to [Drawing B8](#).

Hold the 1/4-inch diameter rod with 15mm protruding from a self-centring or collet chuck. Face off, centre drill using a centre drill with a pilot of 2.5mm diameter or less. Drill 2.6 diameter x 5mm deep. Thread M3. Turn 5.5 diameter x 6mm. File the groove across the threaded face of the nut as drawn, using a second-cut triangular needle file. Part off 3mm

long. Do not lose! Repeat for the remaining five nuts. Put to one side.

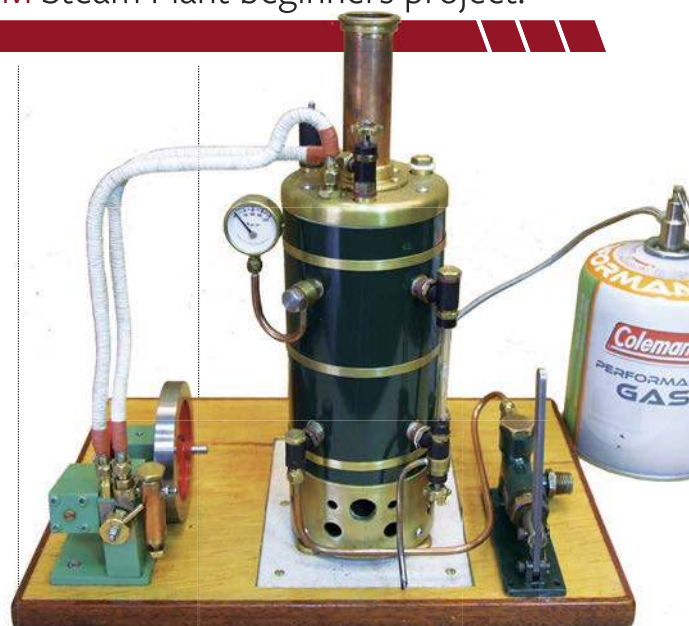
Stays – 1/8-inch diameter, PB102. Refer to [Drawing B9](#).

Cut three 130mm lengths of 1/8-inch diameter rod using a fine-toothed hacksaw. Hold the rod with 15mm protruding in a self-centring or collet chuck. Face off to remove the saw cut and machine 3mm diameter x 12mm. Thread this section M3. I would suggest repeating this for the two remaining stays.

Take each part-machined stay in turn, return to the chuck threaded-end first, face off to bring the length to 129mm. Adjust to have 17mm protruding and machine 3mm diameter x 14mm. Thread this section M3.

Upper Stay Nuts – 1/4-inch diameter, PB102. Refer to [Drawing B10](#).

Hold the 1/4-inch diameter rod with 25mm protruding from a self-centring or collet chuck. Face off, centre drill using a centre drill with a pilot of 2.5mm diameter or less. Drill 2.6 diameter x 10mm deep. Thread M3. File the groove across the threaded face of the nut as drawn, using a



second-cut triangular needle file. Part off 21.5mm long. Repeat for the two remaining nuts.

Taking each partly machined nut in turn, measure the length and deduct 21mm, this is the amount that requires facing off to bring to the specified length of 21 ± 0.1 mm (or set your digital caliper to 21mm and zero as suggested earlier). Return to the chuck, threaded end first with 5mm protruding. Centre drill with a pilot of 2.5mm diameter or less. Drill 2.6 diameter x 7mm deep. Thread M3. Repeat for the remaining three nuts. Put to one side.

This gives you 44 items, and the picture ([Photo 40](#)) shows one of the three stays assembled. Put to one side.

Protection plugs

I'm recommending that the bushes are threaded completely in an effort to make gripping easier because of having a reasonable length of bar for the chuck to grip. Because of this we need to make protection plugs that will prevent the thread from being damaged when the bushes are being silver soldered if exposed to the direct flame.

Protection Plugs x 2, – 10mm diameter Brass. Refer [Drawing B11](#).

Hold in a self-centring or collet chuck with 20mm protruding. Face off and chamfer end 1 x 45 degrees. Turn 9.5mm diameter x 5mm. Thread 3/8-inch x 32 ME. Part off 12mm long.

"The bushes are threaded completely in an effort to make gripping easier..."

B40



Repeat operation for the second plug.

Slot the heads across the diameter to 1mm wide x 2mm deep. Years ago I acquired an old short machine hacksaw blade and I keep it especially for this purpose because it cuts a 1mm wide slot, saving an awful lot of time. If such is not available slot using a standard hacksaw, and using a needle file 1mm thick with teeth on one edge open the slot width out to 1mm width. Put to one side.

Test Plugs x 6 – 10mm diameter Brass. Refer **Drawing B12**.

Hold in a self-centring or collet chuck with 20mm protruding. Face off and turn 6.35mm diameter x 5mm. Using a 1mm wide parting tool, with its left-hand edge set flush with the faced surface, undercut 0.5mm deep into the turned diameter. Thread $\frac{1}{4}$ -inch x 40 ME. Part off 12mm long. Repeat for the remaining five plugs. Slot the heads across the diameter to 1mm wide x 2mm deep as before. Put to one side.

Test Adaptor – 10AF Brass. Refer **Drawing B13**.

Hold in a three-jaw with 15mm protruding. Face off. Centre drill. Drill 2.5mm diameter x 20mm deep. Turn 6.35mm diameter x 8mm, undercut 1mm wide and 0.5 deep as for test plugs. Chamfer hexagon until corners just become a continuous diameter. Thread $\frac{1}{4}$ -inch x 40 ME. Draw out of the chuck to give 50mm protruding and part off 44mm long. Turn around and hold with 15mm protruding. Face off. Centre drill. Drill 2.5mm diameter until the drill breaks through, taking care as it does so. Produce a thread that is compatible with your particular club boiler tester equipment.

Protection Plugs x 5 – $\frac{1}{4}$ -inch diameter Brass – Refer **Drawing B14**.

Hold in a self-centring or collet chuck with 20mm protruding. Face off and chamfer end 1 x 45 degrees. Thread $\frac{1}{4}$ -inch x 40 ME for 5mm. Part off 12mm long. Repeat for the remaining four plugs.

Slot the heads across the diameter to 1mm wide x 2mm deep as before. Put to one side.

Long Protection Plugs – 10AF Brass. Refer **Drawing B14A**.

Hold in a three-jaw chuck with 15mm protruding. Face off. Turn 6.35mm diameter x 10mm, undercut 1mm wide and 0.5 deep as for test plugs. Chamfer hexagon until corners just become a continuous diameter. Thread $\frac{1}{4}$ -inch x 40 ME. Draw out of

“Years ago I acquired an old short machine hacksaw blade and I keep it especially for this purpose...”

the chuck 50mm and part off 40.5mm long. Repeat a further two times.

Turn around and hold with 15mm protruding. Face off, bringing to 40mm length. Turn 5mm diameter x 5mm long. Remove from the chuck and slot across the diameter to 1mm wide x 2mm deep as before. Repeat a further two times. Put to one side.

Sheet layout. Refer **Drawing 14B**.

So as to prevent a costly cut in the wrong place I've included a suggested layout for all the parts required to be cut from the sheet of 16SWG brass included in the metal pack. This includes an allowance of 3mm between each item for cutting in case you only have a hacksaw with which

to cut out the various components.

Alignment Links – 10 x 16SWG Brass x 3. Refer **Drawing 14C**.

Cut three pieces of 16SWG brass to provide blanks 10 x 53mm, Remove any burrs and chamfer to remove sharp edges. Using suitable parallels set up in the mill vice and drill one hole on the centreline 5mm diameter in from one end and a second 5mm diameter hole 52.83 $\pm$ 0.02mm further on. Remove and deburr. Repeat on the remaining two blanks. Bend each link as indicated to give 1.5mm offset as indicated.

This will give you the 20 items required for the assembly and testing of the boiler, **Photo 41**.

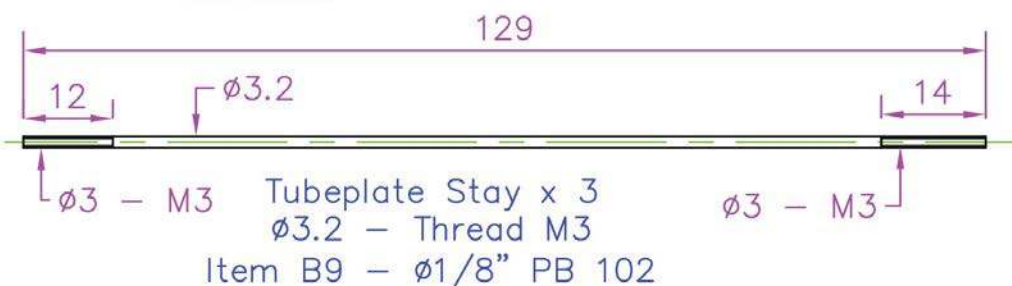
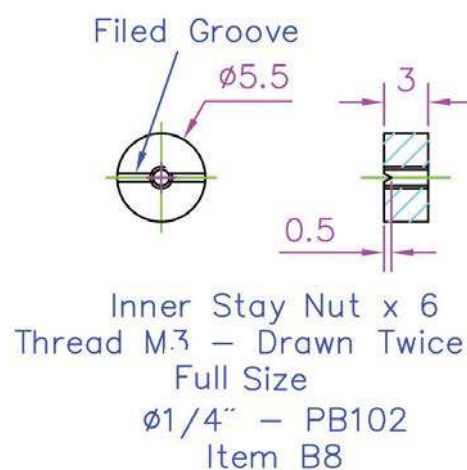
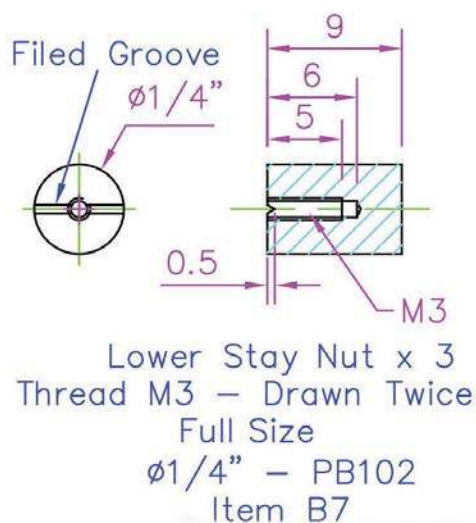
PHOTO B40

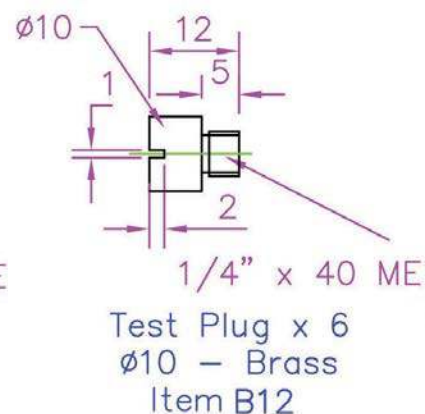
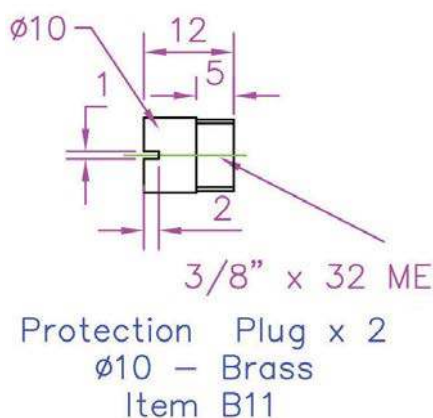
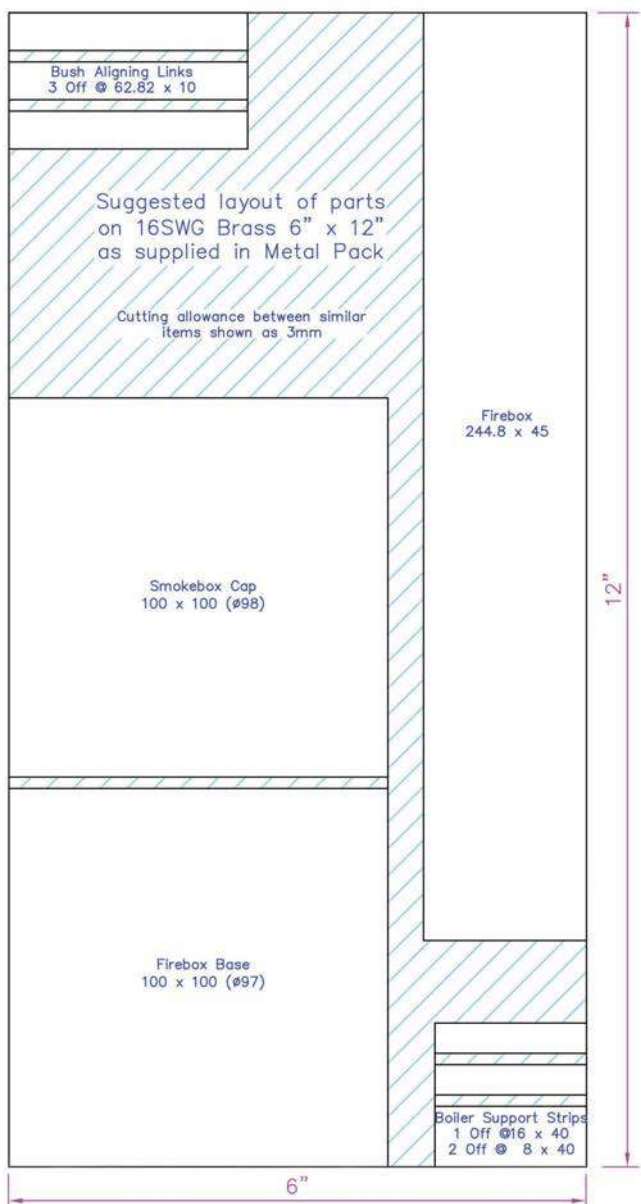
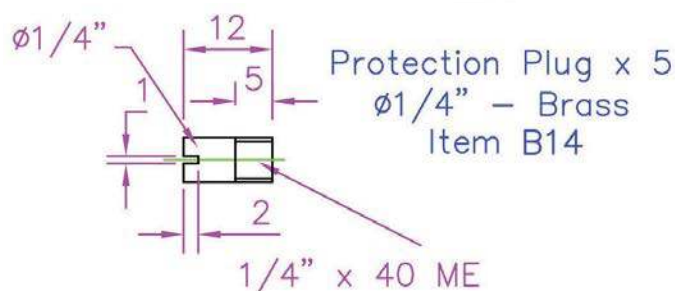
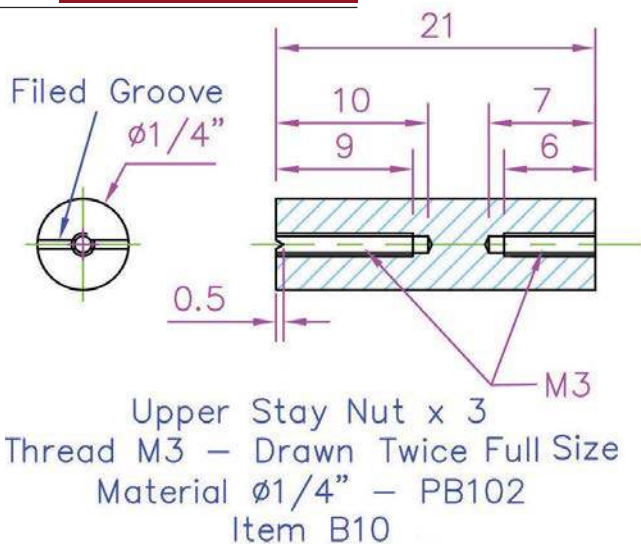
Completed components for the boiler.

PHOTO B41

Components required for assembly and testing of the boiler.

All photos and drawings by Martin Gearing



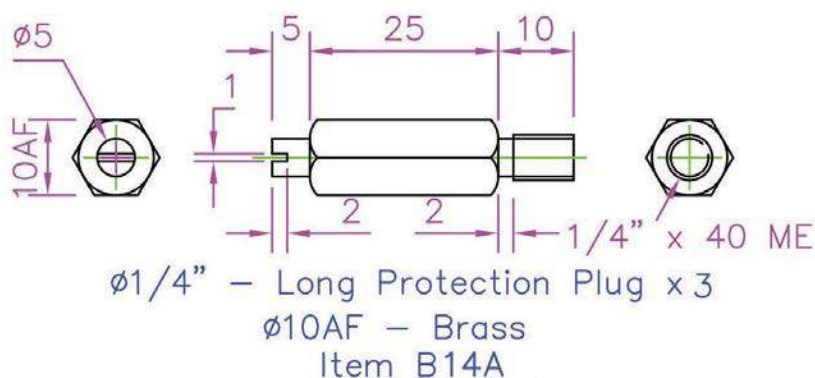
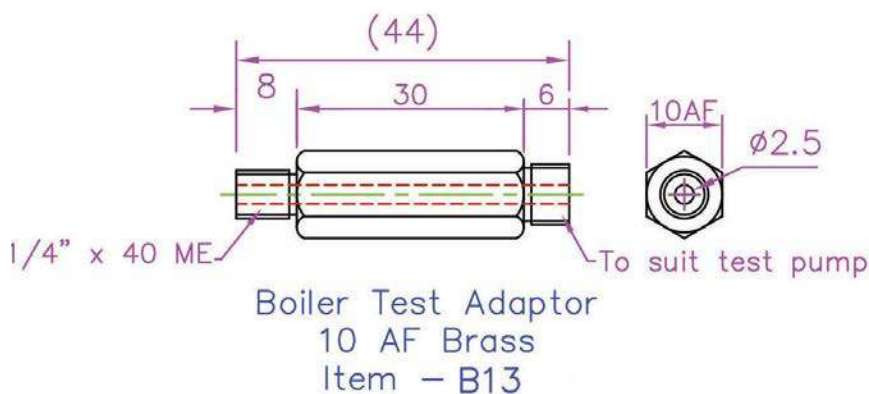


NEXT MONTH...

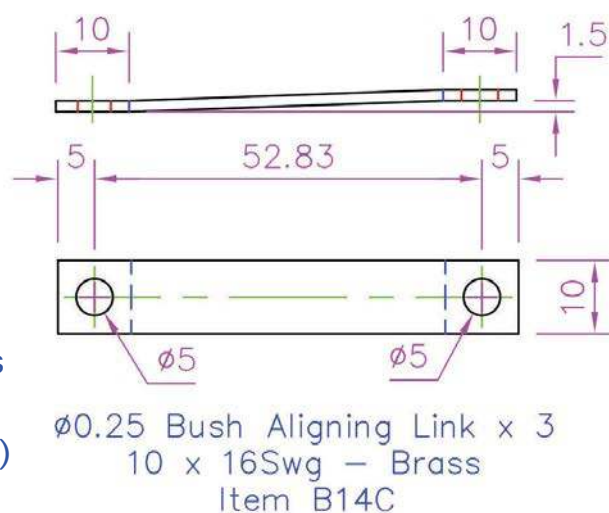
Martin begins to silver solder the components together.

Parts 1 to 4 of this series appeared in the October 2018 to January 2019

issues of **EIM**. Digital back issues can be downloaded or printed versions ordered from www.world-of-railways.co.uk/engineering-in-miniature/store/back-issues/ or by telephoning 01778 392484.



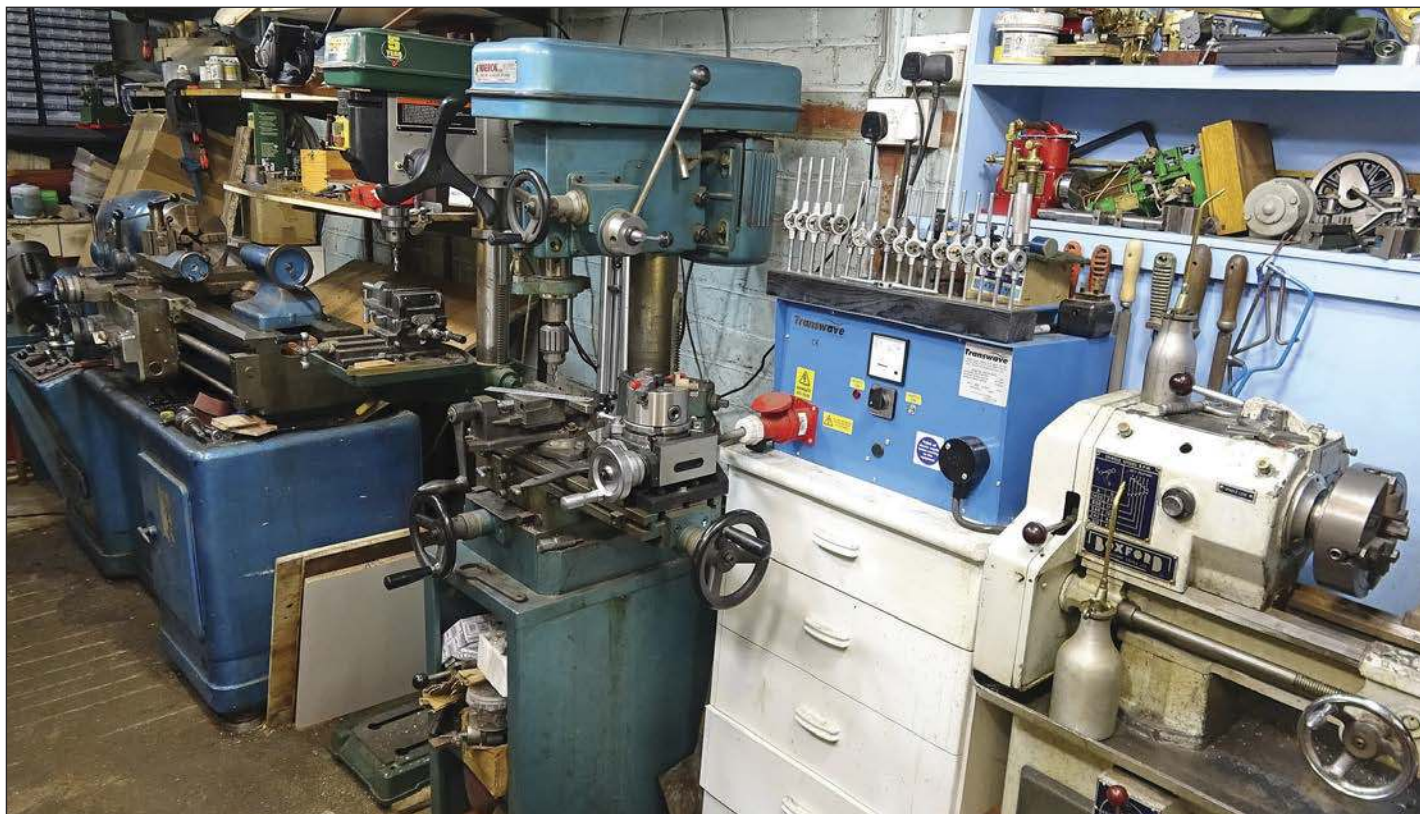
Cutting guide
for sheet
material - brass
(reproduced to
approx half-size)
Item B14B



Creating your workshop

Keith describes how design is essential to your model engineering workspace.

BY KEITH APPLETON



I hope that the information in my previous article (EIM December 2018) was helpful and now maybe you have made the decision to buy a lathe that is suitable for your intended application and within your budget.

Buying the lathe is the first step, but now you will need to plan the general layout of your workshop.

Just like planning a kitchen, all of the items in the workshop need to be in the right place. Lathe tools and accessories need to be near to hand when using the lathe and similarly items such as twist drills will need to be located near to where you will use them most.

For instance, in my workshop I have two lathes (as I mentioned in the previous article) – one is a quite large heavy machine and the other one is a bit smaller and is ideal for lighter jobs. In between the two is a milling machine and a floor-mounted drilling machine. I have two sets of imperial drills in their original holders on the shelves that are situated immediately behind each of the lathes so I can ‘borrow’ drills from the either side of me when I am using the drilling machine. It’s not good for exercise I know, but it saves time wandering about aimlessly in the workshop.

ABOVE: The centre of the inner workshop, the drilling machine and easily accessed tools between the two lathes.

RIGHT: The outer, ‘dirty’ end of the workshop with lots of storage behind the sanders and the grinder.

All photos by Keith Appleton

A model engineer’s workshop is a very personal space and if you intend to spend a lot of time in there it’s worth studying the best way to position the machinery in order to maximise the space available.

Most home workshops function as a ‘Man Cave’ so don’t forget to leave some space for your creations in the workshop itself. Currently I have model steam engines in my dining room and dare I say it, even in my bedroom. I can do this because sadly, my wife is no longer with us. She lives

in a flat down the road so now I can do things like clutter the dining room as much as I want with total impunity.

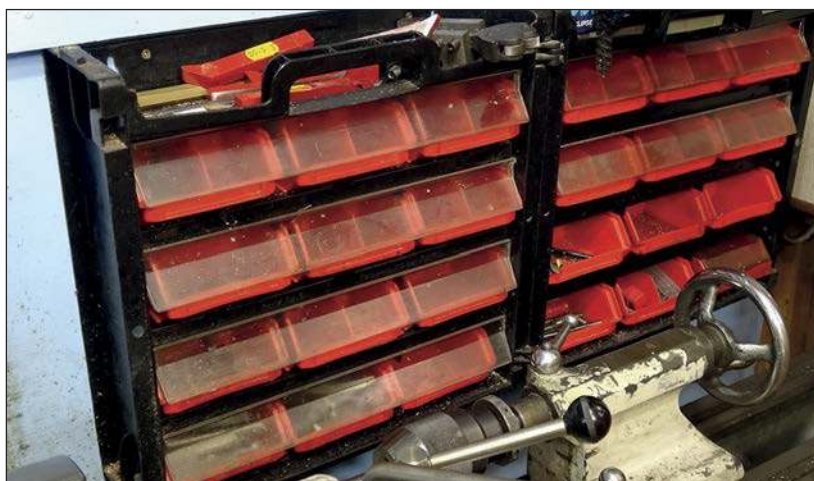
The Workshop Layout

Personally, I find it very important to designate areas of the workshop for different jobs, I have a ‘Dirty’ area and a ‘Clean’ area.

The Dirty area contains my finishers (belt sanders), grinders and a large heavy-duty vice.

This is the part of my workshop where I silver solder components, so





ABOVE: Well away from the dirty end, the electricals.



UPPER & LOWER LEFT: Plenty of storage is essential in a workshop, for the smallest bolt to the largest tool.

BELOW: A strong, firm workbench is a most basic requirement of the workshop.



my acid bath also lives there, plus it is in this same area where I frequently remove paint and degrease items using powerful solvents as well as spray painting. This part of the workshop is also very close to the outside door (which is a roller-shutter type garage door) and so the Dirty area is very well ventilated once the shutter is raised.

Health and Safety rules can be a bit of a pain, but there can be considerably more pain and suffering if you ignore 'common-sense' Health and Safety procedures. It is not just a case of buying a load of engineering equipment and randomly putting everything into a space and then calling it a workshop.

You will need to think about storage areas for your stock of metal for instance. Metal is heavy and needs a substantial bench to carry the weight. I have smaller containers for smaller pieces on a strong table, and underneath this table on the floor are containers holding larger and heavier pieces of metal.

The Workbench

One of the most important parts of the workshop needs to be constructed. This is the main workbench and it is where you will spend the majority of your time in the workshop. If you watch my tutorial videos for beginners on www.youtube.com/keithappleton ('Model Engineering for Beginners' is a good place to start), most of the time the video camera is pointed at something happening on the bench.

Your workbench needs to be very solid and strong, and I also advise having convenient storage areas underneath such as cupboards or shelves for all sorts of the wonderful things that you find in a workshop.

It is essential to have a seating arrangement that suits you. We are all of different shapes and sizes, I am a big fat hairy man with a long body and short legs, I am around six feet tall, but I think that I should have been a lot taller, more like seven feet to be in scale.

When selecting a suitable workbench seat, soft furnishings are not a good idea as they will retain sharp metal particles and bits of swarf that fly off, and these over time could cause pain and suffering in the more delicate areas of your anatomy.

I find a simple hard-topped stool to be the best solution but the height is quite important. My workbench is a long commercial woodworking bench and my seat is an old kitchen stool. This seems to work for me.

If the seat is too low you may have problems over time as your arms will be held high all the time to be in a position to work on items on the

bench. Put some thought into this, because over time you could generate repetitive strain injuries (RSI) if the seat and workbench height are mismatched and not relative to your physical dimensions.

Workshop Lighting

Good lighting is very important in your workshop and there are many choices available, such as Thermal, LED or Fluorescent.

Thermal lighting, such as normal filament bulbs including halogen types are okay, but they do get hot and use more power than alternative types.

I prefer the modern **LED lighting** in either a diffused strip light format or the newer filament-like LED bulbs, this light is bright and suits me best. Also if running costs are a consideration, then I would recommend LED lights to be fitted to the ceiling.

I can detect flicker in **Fluorescent lighting**. Not everyone has this problem, but I do. I also find that the strobe effect of fluorescent lights can cause problems when you are staring at a revolving lathe chuck for prolonged periods.

Another 'Health and Safety' common-sense Warning – any lights located near machinery need to be of **low voltage** and not the 240-volt mains type. Note too that when it comes to fitting suitable lighting in any areas of your workshop I always recommend consulting a qualified electrician. In my workshop I have an industrial E.L.C.B. (Earth Leakage Circuit Breaker) fitted as an additional safety feature.

Hold fire

Assuming that you now have a lathe and you have placed it in your new workshop, you will be quite excited and positively itching to plug it in and get started. My advice is to stop and think first.

Become familiar with the machine that you have before you plug it in. Is it electrically safe? Is the lathe's motor and contactor (on/off switch) Single Phase or Three Phase? Does it need a Phase Converter?

If in doubt employ the services of a competent electrician to wire it up for you. Once it is wired up and ready to go, before throwing the mains switch to the 'ON' position, check things such as:

- Is the chuck fully tightened on the lathe spindle?
- Are the chuck jaws closed?
- Is the toolpost securely mounted on the top slide?

I mentioned in the previous article that the lathe needs to be sat on level ground and I assume by this time that this is the case, so that when the lathe



ABOVE: The acid bath, with its essential secure cover in place, and with it removed (Keith's sense of humour is very evident!)

ABOVE RIGHT: LED strips provide an efficient lighting of the workshop.

BELOW: The left-hand end of the workshop – note the plentiful supply of electrical sockets on the wall behind.



is powered up it will cut metal accurately and not move around the workshop floor when doing this.

All this is common sense maybe, but once upon a time when I was a beginner I bought my first Myford lathe and couldn't wait to get started so I plugged it in, failing to notice that the lathe was set to run in reverse and as the machine suddenly started running backwards at high speed, unfortunately the chuck was loose and proceeded to unwind itself from the threaded spindle, spun off the spindle and chipped the edge of the lathe bed on the way to the floor, narrowly missing my foot.

This may sound like a stupid thing to do – it felt tragic to me at the time and I remember it well as this was a brand new Myford lathe. Being a little

too over-excited at the time of setting up your first lathe can be dangerous.

Once the lathe is installed and ready to go, my advice is to just sit back and relax before you start. Check every setting methodically before switching on the lathe.

If you are a complete beginner to this fascinating hobby, the main thing that you need to do is gain experience, and the best way to do this is to start making things using your newly acquired workshop equipment.

In the next article in this series I am going to show how to make some very simple and extremely useful tools for use in your workshop. Now that you have the technology installed it is not always necessary to rush out and buy every bit of simple tooling – why not make some of it yourself? **EIM**



Friedrichshafen 2018

They do things bigger in Germany, as John discovered when attending this major model engineering exhibition in a southern German city famed for its aviation history.

BY JOHN ARROWSMITH



PHOTO 1:

A well loaded train departs the station hauled by a 7¼-inch gauge 0-6-0 Waldenburg.

PHOTO 2:

A view from the first floor of the indoor flying area.

PHOTO 3:

One of the areas devoted to working radio-control vehicles that included full scenery and a railway line.

All photos by John Arrowsmith

This large model engineering and modelling exhibition was held at the Messe Friedrichshafen from the 1st to the 4th November and was presented in seven halls, each of which was about the same size as the Great Hall in Alexandra Palace that houses the entire London show.

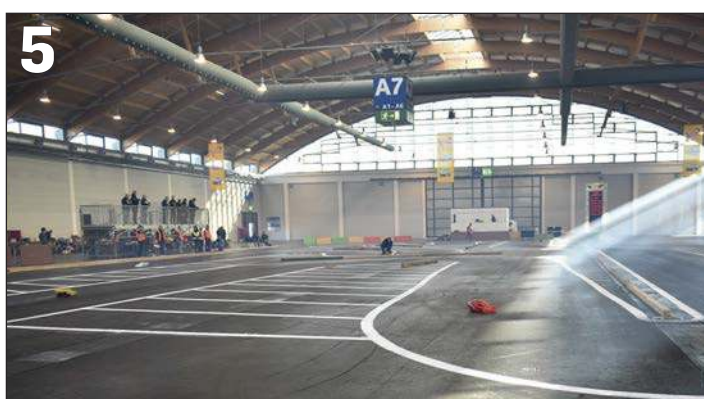
In addition to this vast space there was an outdoor boating lake for the real fast hydroplane-type craft, a full-size flying area which was part of the local airport and a large operating space for a 7¼-inch gauge railway as well as a circuit for car racing. Combine all this with 53,000 visitors and you can imagine how big this show has become.

Faszination Modellbau, Friedrichshafen as it is known in Germany features so many aspects of modelling and model engineering that no report can do justice to all of it. One outstanding aspect I did note, however, was that each of the five main exhibition halls covering each discipline provided instruction areas where visitors of any age could try their hand at making a model relating to the aspect of the hall.

For example, in the aircraft modelling section there were three areas of this type and they seemed to be getting plenty of customers. It was a much larger version of the activity zone used at Alexandra Palace. I think



4



5



6

this is the sort of area UK shows should be considering as a way of an introduction to model engineering and modelling in general.

Every discipline you could think of was included and in some areas the presentations were created to have maximum impact. For example the introduction to a demonstration by one of the radio-control road vehicle organisations featured loud music, smoke and all the razzamatazz of a pop concert – the crowds and particularly the youngsters loved it.

Water space

The large indoor boating pool was about one metre deep and 80 metres square, a big expanse of water that the boat clubs made full use of. A raised control platform enabled the demonstrators to keep a close control of their boats and ships and three large fans provided airflow for the sailing ships.

Alongside the pool an enormous range of static displays showed off many different types of craft from small fishing vessels to large naval ships. There was even a steam-powered gas-fired canoe on display that while not used on the pool, simply puffed away quietly throughout each day of the show.

The indoor flying area was another extensive space that saw quite ▶

PHOTO 4:

On the large pool was this excellent model of a freighter.

PHOTO 5:

Hall 7 was occupied by the fast motor racing circuit.

PHOTO 6:

One of many instruction stations that were located throughout the exhibition.

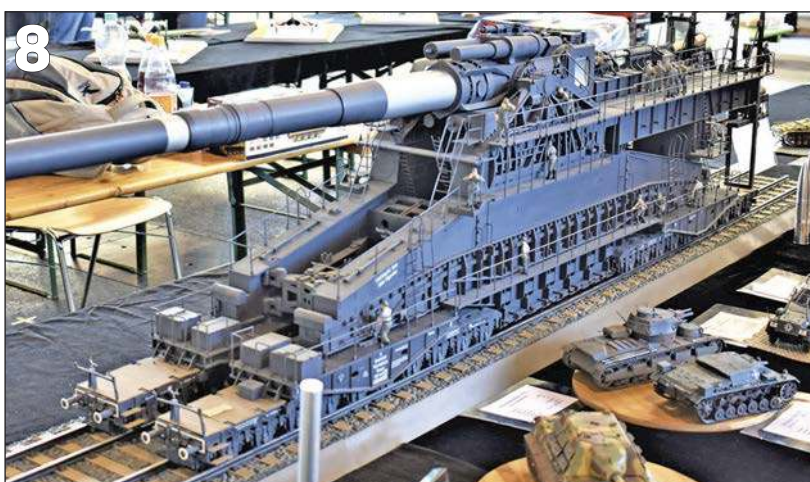
PHOTO 7: A couple of nice smoke rings as this tank train makes its way round the layout.

PHOTO 8:

The amazing cannon 'Dora' running on twin O-gauge railway lines.



7



8

large aircraft performing aerobatics to entertain the visitors. This space was about 50 metres square and a good three storeys high, and patrons of the first-floor restaurant could enjoy all the displays without leaving their tables.

The radio-controlled road vehicles had a full hall to themselves and I was informed that 90 tons of soil had been included in it, this then seeded and watered to provide a ground cover. Additional trees and bushes made it look very realistic. This facility was made full use of by the participants with a very wide range of diggers, mechanical shovels, dump trucks and lorries all busy moving this soil around. An additional display used snow as the ground cover on a hillside so as to show a different range of vehicles in action.

Model and garden railway devotees had one hall for the smaller gauges and space in the engineering hall for the larger gauges. This again provided a wide range of prototypes, gauges and detailed scenic displays, and some of the locomotives had the usual steam generators in action to add to the overall effect. One model in particular that caught my eye was the large rail-mounted artillery gun nicknamed 'Dora' – it was a huge model on twin O-gauge tracks.

Not this year

In the engineering area a wide range of steam and internal combustion models were on display, some showing exceptional levels of workmanship and detail. I was a little disappointed at the number of larger locomotives and traction engines on display but was informed these sections are included every two years and the 2019 event should see a much larger grouping of these models.

The quality of the work on show in this section was very pleasing, while most pleasing of all was that most of the models were working either on steam, air or gas which made for some interesting operations.

Another noticeable difference to UK shows is the lack of alarm systems or substantial personnel barriers employed on models, which makes a



"Visitors were expected to be responsible for their own actions..."

considerable difference when taking photographs. It did seem to me that the restrictions that are imposed on events of this sort in the UK do not seem to apply at this event. For example the 7¼-inch gauge railway was laid in a large outside space with about 500 metres of track on the ground in a continuous loop, fully accessible to anyone who cared to walk round it or over it. There were

no barriers and no signage of any kind, visitors were expected to take responsibility for their own actions.

The outside flying programme was extensive, running from 11am to 4.15pm each day. With the area being part of the local commercial airport it gave the flyers plenty of space both on the ground and in the air to show off their expertise, inbetween commercial flights of course. Can you imagine

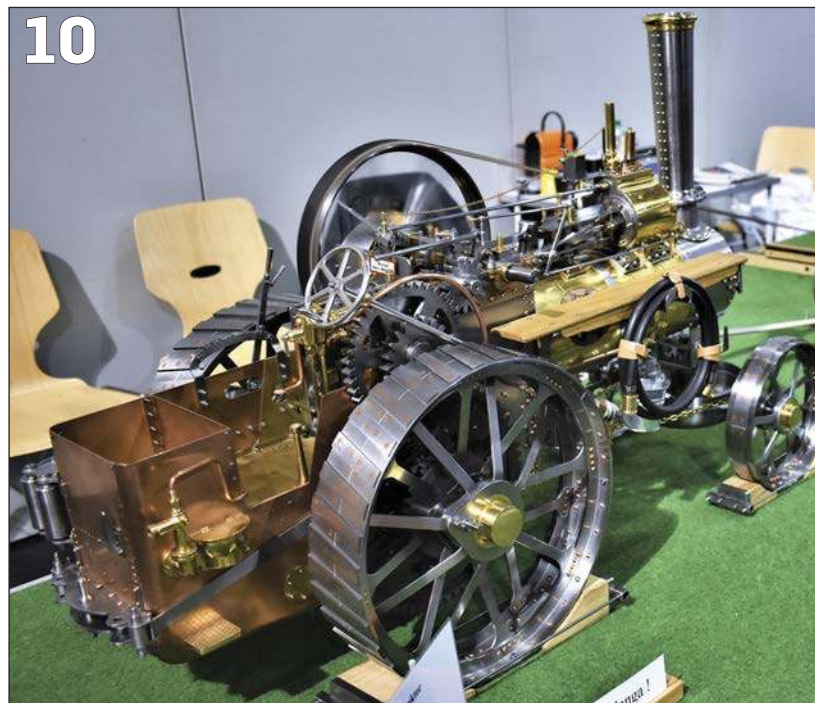


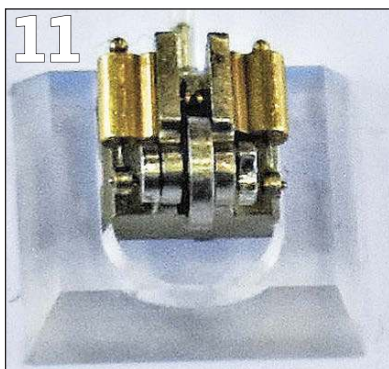
PHOTO 9:
A saw-planking machine was working very effectively all through the show, the power provided by...

PHOTO 10:
...this very well made 2-inch scale Fowler traction engine.

PHOTO 11:
The smallest operating oscillating engine in the show, smaller than a 5p piece.

PHOTO 12:
Magnus Altherr is building this Bo-Bo class 216 locomotive in 5-inch gauge.

PHOTO 13:
An interesting twin cylinder hot-air engine.





13



14

that being allowed at Birmingham airport for example? I don't think so! This they did very well with some quite spectacular displays plus the obligatory Zeppelin airship (*Friedrichshafen is home to the Zeppelin museum – Ed*) which appeared regularly on the hour. The outside boating lake was also well used with very high speed craft operating on a regular basis.

Faster than the eye...

Two other large halls contained high-speed demonstrations to provide continuous entertainment. The full motor racing circuit was a hive of noise, smoke and activity, how these are controlled at such high speeds I don't know but they certainly put in a shift for spectators. In the final display area drone racing featured – these machines were even faster so that the

PHOTO 14:

A delightful De Dion steam car of circa 1883, built by Friedrich Proßegger in 1:6th scale.

PHOTO 15:

Super example of a Class 80 0-6-0 shunter in 5-inch gauge.

PHOTO 16:

Many Lanz single cylinder tractors were on display.

PHOTO 17:

Fine example of a double beam engine with its name 'Dancers End' being the location of the original engine in England.



15



16



17

naked eye could not really see anything, but you could hear them and occasionally get a flash as one caught the sunlight. The operators apparently wear special goggles to enable them to control the flights. The machines flying when I was there were about the size of an average human hand.

I hope this very brief look at this very large exhibition has given you an insight to what happens on the Continent, it is certainly bigger than anything seen in the UK and it appears to be much more appealing to families. There were many family groups attending which confirms the attractive nature of the exhibition.

If you are perhaps considering attending the 2019 event, do not be put off by it being such a large show. UK visitors are very welcome and stand holders are very helpful when you need to ask questions. A regular trader from the UK was staying at the same hotel as I did and conversations with him showed that British attendance is very much appreciated, they were doing very good business. All displays and demonstrations included a wide age range of stewards and operators but the number of young people involved was very impressive.

In concluding my notes I must thank the organisers Messe Sinsheim GmbH and the project manager Sascha Bürkel in particular for his help and assistance during the show, it was much appreciated, as was the company of the 12 other members from the Hereford club who went with me, including two of our young engineers, it was a very enjoyable experience.

More information

The 2019 Faszination Modellbau will be held in Friedrichshafen between 1st-3rd November. More details of the event and advance ticket booking can be found on the website www.faszination-modellbau.de which includes English language pages. **EIM**

Making a clock hand removing tool

Mark constructs an essential item for the horologist's tool chest.

BY MARK BROCKLEY

Clocks, be they constructed new or an antique in need of overhauling, will inevitably require to be dismantled at some point. When this time arises, usually after a good number of years, the first task is to remove the hands.

This can sometimes prove to be difficult as the hands will have become stuck fast or due to their size, especially on smaller clocks, they will need some sort of assistance. To try and pry them off with a lever (usually the first screwdriver that happens to be close by) can result in damaging a delicate hand.

Worse still the screwdriver might slip and you can be sure it will cause irreparable damage to the dial. If clock hands can't be easily removed with your fingers then a suitable hand puller, as shown in use in **Photo 1**, is the best tool to use.

Lack of choice

Photo 2 shows a selection of pullers I have made. The smaller two are made on the same principle as commercially available pullers from clock-maker suppliers. However there is usually only one commercial size available, which is suitable for medium-sized wall and mantle clocks. Therefore I eventually designed a puller with adjustable pulling legs to accommodate a variety of sized hands.

Figure 1 shows all the components required for this adjustable hand puller. Start with a short length of bright mild steel and turn down to 32mm (**Photo 3**).

Drill or bore out to 22mm for just over 12mm deep then part off. Face off the freshly parted end to length. After removing any sharp edges transfer to the milling machine vice and hold firmly (**Photo 4**).

With a suitably-sized end mill remove a depth of 10mm to form the opening for the adjustable legs. Clean off any burrs from the component and then drill and tap the two 6BA threads in the puller body.

The next job is to invert the body in the vice, packing it on a suitable parallel then after taking a 1mm skim to aid the positioning of the pulling pin, drill and tap M4.



PHOTO 1: Finished puller posed how it would be used on a clock.

PHOTO 2: Pullers can be made to suit a variety of sizes of clock.

PHOTO 3: Starting point – turning down the mild steel rod.

All photos and drawings by Mark Brockley

FIGURE 2

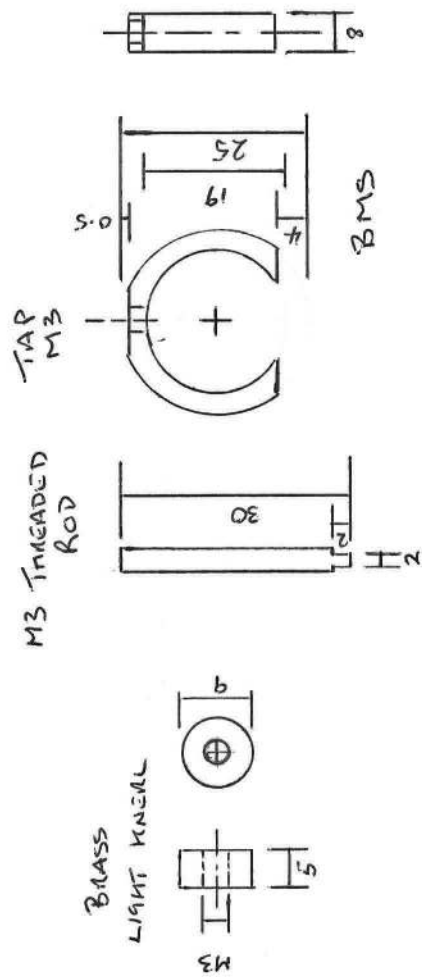


FIGURE 3

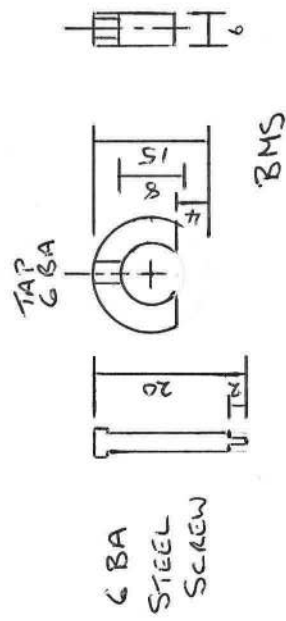
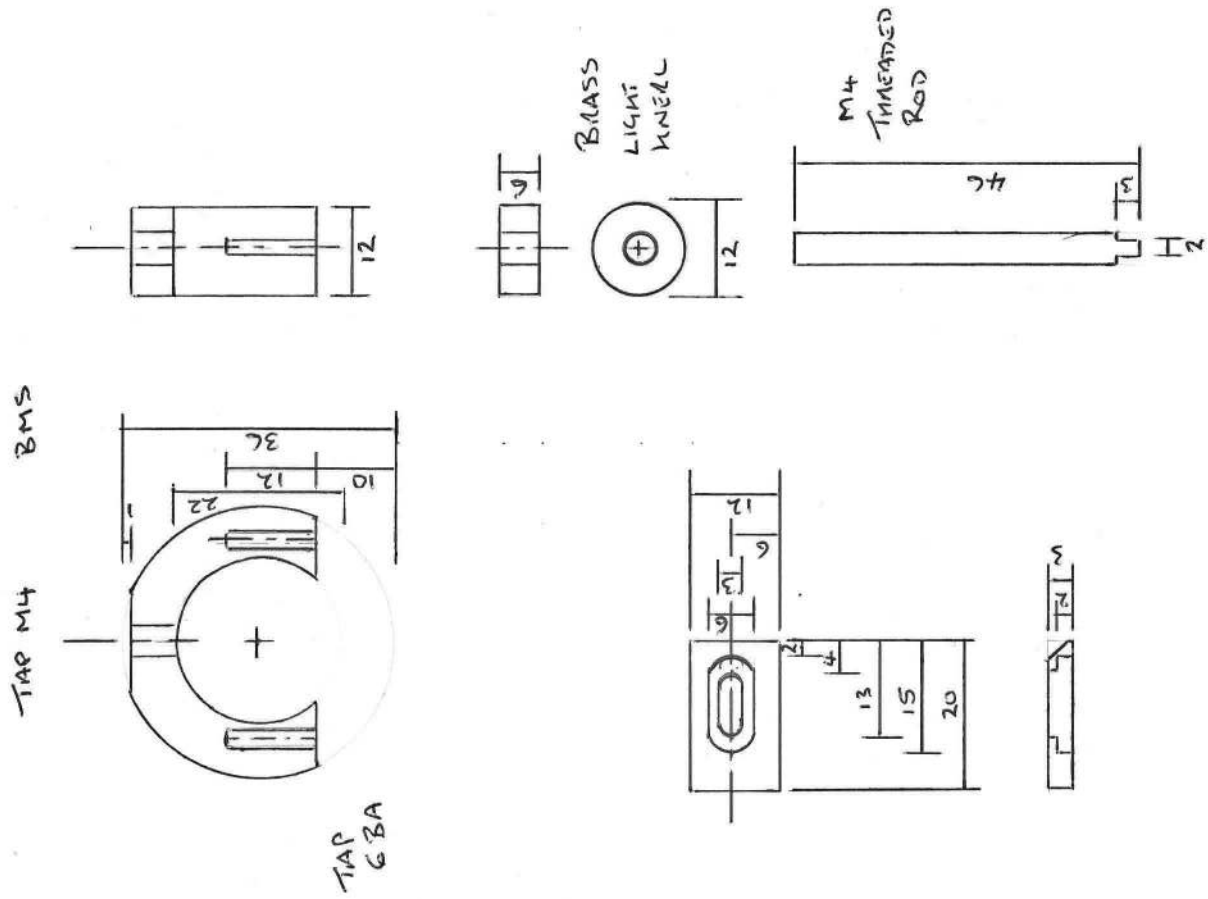


FIGURE 1



CLOCK HAND PULLEYS

SCALE 1:1 14-1-16 ©

DESIGNED BY Neil



Bar from the bits box

I had a rummage through my offcuts box and found a piece of 13 x 3 flat bar left over from making scrolls for a gate. I decided this was an ideal size for the legs and first skimmed half a mm from each edge to remove the rounded edge from when it was rolled in the mill. I then used course emery cloth to bring up a bright surface on both sides.

Photo 5 shows the slot and counter-bored slot for the screw head being machined. Machine the 3 x 13 slot first and then the counter-bored slot 15 x 6 approximately 2mm deep so the screw heads are below the surface when tightened up.

After making two legs cut them to around 1mm over size each end and then fix the two together with six BA nuts and bolts as shown in **Photo 6**. Square up the ends in the

PHOTO 4: Forming leg opening on end mill.

PHOTO 5: Machining slots for screw head.

PHOTO 6: Finished leg made up.

PHOTO 7: Final job to do, making the puller pin and knurled hand nut.

mill finishing them to an overall length of 20mm.

Next you can either file or like me use a pair of vice grips and a bench grinder to put the chamfer on each leg. After this remove any sharp edges left from the machining, making sure that the slot has no burrs and the bolts slide freely.

The final parts to make are the puller pin and knurled hand nut. Machine a piece of brass bar to 12mm diameter then drill and tap just over 6mm depth M4. After finishing the surface with a light knurl part off just over 6mm (**Photo 7**) then tidy up the parted end and finish to length.

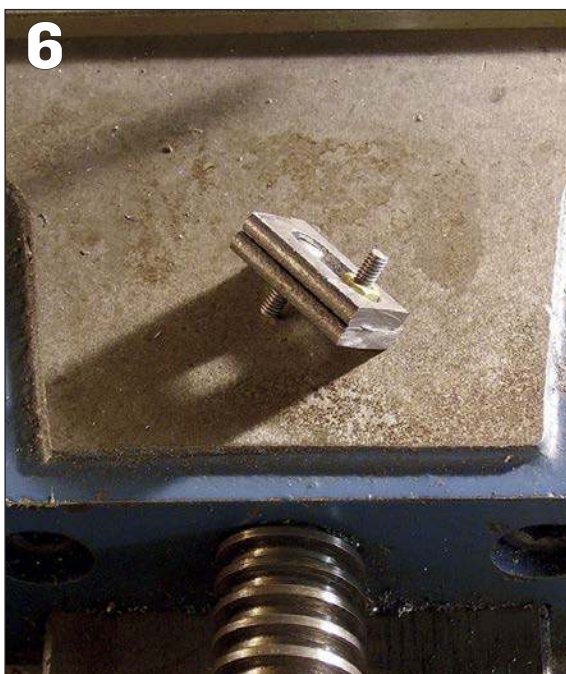
Next a piece of M4 threaded rod just over 46 mm in length is chucked and the ends faced clean. On the one end turn down to a diameter of 2mm by 3mm long, then spot with a centre drill and just open up with a 2mm

drill to put a nice concave in the end. This will help keep the pin centred on the minute hand shaft when removing the hand.

The heading picture, photo 1, shows the finished puller in use on a wall clock. Eagle-eyed readers will be quick to spot the hand pin and collet still on the clock. This was due to the clock already being serviced and the hands already loose – I just used this particular clock as it was in a convenient place to take a photo.

Size to suit

Figures 2 and 3 give the dimensions for the standard pullers I have made but any of the sizes given could be altered to suit the job in hand. A selection of puller pins can also be made with different diameter concave faces to suit a wider variety of minute-hand shafts. **EIM**



Seat of the problem

Harry starts a new series highlighting common mistakes and how they can be avoided.

BY HARRY BILLMORE

One of the many cock ups that may occur as I machine various components happened just yesterday. I was machining some rail adapters to transfer from heavy 6lb a yard rail down to light aluminium rail that will be used for some temporary point work.

I set the jobs up in the milling machine to mill the heads down until they were flush with the web of the rail, before drilling them through with a matching set of holes with the aluminium rail web.

I used my tried-and-tested method of mass production on manual machines, namely by finding a datum point on the workpiece that lines up with something.

In this case it worked out nicely that the end of the rail section I was machining fitted nicely to the end of the vice jaws with enough overhang at the other end to machine the correct length step. This then allowed me to use the same knee height setting and a reasonably deep cut depth to machine the parts in one pass.

However as the photos show, this plan did not quite work as anticipated all of the time. Out of the 18 parts that I machined, there were two that ended up as shown, still with a small amount of the rail head left above the web.

Compounding the error

I then made a second mistake – I assumed the difference was in the rolled rail and not due to my inadequate setting up, so I carried on machining and finishing the part before discovering that the aluminium rail then would not fit correctly to it, both sitting proud and slightly wonky to it. So what was my problem?

It was quite simple really – when I had clamped the rails in the vice, I had not correctly seated the bottom of the foot of the rail against the vice jaw, and when I clamped it up, because of the shape of the head, it tightened up nicely and held very steady, just at a slight angle.

This mistake was easily corrected by setting the part up again properly with the foot seated correctly this time around and re-machining the part.

In this instance the result was a small waste of time, but if it had been a large casting or a complicated machined component then it could have resulted in a huge waste of time

"I used my tried-and-tested method of mass production on manual machines..."



and money! So always make sure that whatever fixture you are using to hold your work piece, that it is mounted correctly every time.

■ Have you made a silly mistake and learnt from it? Why not tell your fellow readers about it? Write to the address on page 3.. **EIM**

ABOVE RIGHT: Two machined versions of the rail, the one on the left is correctly machined, the one at right was sent awry by the lip.

RIGHT: From the end of the rail, with the irritating lip on the top example.

Photos: Harry Billmore



Baybrooke collection goes up for auction

The March Transport Sale of Newbury-based auctioneer Dreweatts will feature a collection of live-steam locomotives amassed by the late Lord Braybrooke, founder of the 10¼-inch gauge Audley End Miniature Railway in Essex.

The steam locomotives going under the hammer include 3½-inch and 5-inch examples, and four of the nine 10¼-inch gauge engines built by noted miniature railway engineer David Curwen for the Audley End line. The collaboration and friendship between Lord Braybrooke, who died aged 85 in June 2017, and Curwen endured for 40 years, and dated from the early 1960s when Robin Neville, later Lord Braybrooke, approached Curwen to advise and assist in the supply of locomotives for the railway he planned at Audley End.

The railway (www.audley-end-railway.co.uk) has since grown into a popular visitor attraction with adults and children, and the sale of these locos does not affect the future of the line, as Lord Braybrooke's daughter, Amanda Murray, explained. "Unfortunately his collection of smaller locomotives were not designed to haul eight carriages around the 1.5-mile track, which is what our visitor numbers now dictate," she said.

"So to ensure we carry our passengers as efficiently and as comfortably as possible, we have made the decision to sell the smaller locomotives. We will retain the largest and most efficient locomotives which are perfect for our needs, as well as the diesel engines.

"We plan to use the funds raised from the Dreweatts auction to make significant improvements and enhancements to our visitor attraction... ensuring the future of the railway and my father's legacy."

Lord Braybrooke and Curwen shared mutual respect, Curwen stating that the owner of Audley End should have been an engineer, such was his appreciation of the challenges in creating engines from scratch, while Lord Braybrooke credited Curwen, who died in 2011, with making the railway a success by building suitably robust locomotives for a commercial operation.

The collection on sale includes;

- 1) Exhibition quality 10¼-inch gauge Great Western Railway Star Class 4-6-0 'Polar Star', which has an estimated sale price £25,000-£30,000 (plus fees)
- 2) 10¼-inch gauge London North Eastern Railway 'Ivatt' Atlantic Class 4-4-2 no. 4433, built by David Curwen and Edgar Newbury, circa 1964. (£20,000-£30,000)
- 3) 10¼-inch gauge rebuilt American-outline Atlantic 2-6-2 'Lord Braybrooke', no. 3548,



ABOVE: The four 10¼ inch gauge models in the auction, with 'Lord Braybrooke' leading.

BELOW: Other models up for auction include an LNER 4-6-2 'Mallard' in 5-inch gauge, built by John Richardson, and a LNWR Precursor class 4-4-0 in 3½-inch gauge, builder unknown.

BOTTOM: This 4-6-2 Duchess class in 7¼ inch gauge was built by Harry Powell, who worked at Crewe. It is predicted to sell for between £100,000 and £150,000.

Photos: Dreweatts



built by David Curwen circa 1948 and rebuilt as a Prairie in 1981 (£20,000-£30,000)

4) 10¼-inch gauge Ffestiniog Hunslet saddle tank 'Barbara Curwen', 2-4-2, built by David Curwen, 1997, (£20,000-£30,000). This was the last 10¼-inch steam loco built by Curwen.

5) Exhibition quality 5-inch gauge British Railways Standard Class 4-6-2 'Britannia' no. 70000, built by D Ketley in around 1970, (£6,000-£8,000)

6) 5-inch gauge London North Eastern Railway A4 Pacific 4-6-2 'Mallard' no. 4468, built by John Richardson of Halifax and described by the auctioneers as "fine exhibition quality". (£15,000-£20,000)

7) Exhibition quality 5-inch gauge London Midland & Scottish Railway Royal Scot 4-6-0 'British Legion' no. 6170, built by Eric Lowe, circa 1985, (£10,000-£15,000)

8) Exhibition quality 5-inch gauge Great Northern Railway Stirling Single 4-2-2 no. 53, built by John Richardson, circa 1983, (£5,000-£7,000)

9) Exhibition quality 3½-inch gauge London North Western Railway Precursor Class 4-4-0 'The Achilles' no. 310, builder unknown, (£3,000-£5,000).

There are several other notable models in the March auction, not least the exhibition quality 7¼-inch gauge LMS Stainer Pacific 4-6-2 no. 6230, 'Duchess of Buccleuch'. This was built, using original Crewe drawings, over a decade by Harry Powell, with paintwork and lettering by Louis Raper. Powell worked at Crewe locomotive works, as a master coppersmith and chief of the

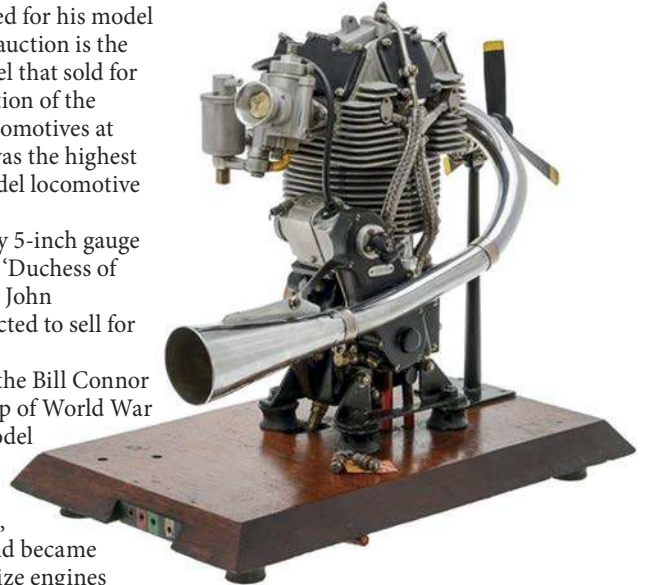
copper-shop and was renowned for his model engineering – the loco up for auction is the sister engine to a similar model that sold for £170,800 aggregate in the auction of the Salem Collection of model locomotives at Dreweatts in April 2012. This was the highest auction price paid for any model locomotive of the type or gauge.

Another exhibition quality 5-inch gauge model, of a LMS 4-6-2 Pacific 'Duchess of Atholl', recently completed by John Richardson of Halifax is expected to sell for between £25,000 and £30,000.

The auction also features the Bill Connor Collection, comprising a group of World War I aero and motorbike scale model engines, many of them winning awards.

Connor, who died in 2018, adored motorcycle engines and became renowned for building half-size engines dating from the 1930s to the 1960s. Having no plans to refer to he took photographs and measurements and made his own drawings.

The sale takes place on 12th March at Dreweatts auction rooms in Donnington, Newbury. Further details can be found at www.dreweatts.com



ABOVE: Among the Bill Connor collection on sale will be this half-size working model of a 1938 350cc Velocette racing motor cycle engine. The model is expected to be sold for between £1000 and £1500 and the gold medal won by it at the Centenary Model Engineering Exhibition in 2007 will be sold with it.

Live steam models – Mrs Ruby Jeffery

Sad news reached the **EIM** editorial office just before Christmas with an announcement from Live Steam Models that former chairman Ruby Jeffery had

sadly passed away on 30th November.

EIM sends our condolences to all involved with the long-established family business following this sad loss.

LETTERS

Comments don't respect the builder...

Not too shiny

With regard to the too shiny model debate (*editorial, December*) The men that built the full-size engines like Mr Alan Boot's fine model spent a lot of time giving them the best workmanship and finish possible. The maintenance and cleaning staff did the same.

They were justifiably proud of what they had created and were maintaining. I think the superb finish of Mr. Alan Boot's model reflects this same approach, so I would say he captured the spirit of the locomotive perfectly.

The 'shiny' comment at the Midlands show was a shallow one and typical of comments of its type, disregarding the effort and the feelings of the builder.

From about 25-30 years ago until about 10 years ago, reading another model engineering magazine I often used to cringe at the scathing comments printed after the judging at major exhibitions. Beautifully made models were regularly derided as "disappointing" or "workmanship could have been better on the finish" or "more effort needed on valve linkage motion".

Comments were made about the scale

aspect, such as missing a rivet here or having a nut .003-inch too large there or the paint colour of the orange pinstriping being off a quarter of a shade, or some hidden underframe surface being red where the original was black.

These comments resulted in several notable and expert modellers not exhibiting at major events any longer and some very bad feeling all around. I can't imagine how anyone could say these things about someone's years of effort and excellent workmanship, whether or not they were strictly historically true. How did it help the hobby? The shiny comment is in the same bad category.

I enjoyed the great report on the Midlands show by Mr. Arrowsmith. I'm also glad to read Mr Doug Hewson's Y4 series will resume in future - I looked forward to it every month when it was in progress earlier.

Jeff Dayman

Help on Don Young design

Can you or anyone help please with a problem I have with the 5-inch gauge Hunslet loco designed by Don Young. I am

looking for details of the spring for the for the steam chest balance valve.

The original drawing gives some details but not the poundage or the compression. Is there a supplier for the springs? Any information you can provide would be gratefully received.

Tony Etches

The editor writes: If anyone can supply an answer to this question please contact the editorial office and we will pass on the information to Tony.

2.5-inch errata

In our feature on the 2½-inch gauge Association last month we managed to add an erroneous '.uk' to the Association's web address. The correct address is <http://n25ga.org> - apologies for the error.

Model engineering query to have answered or a point to make to your fellow readers? Email andrew.charman@warnersgroup.co.uk or write to 12 Maes Gwyn, Llanfair Caereinion, Powys, SY21 0BD.

No slacking over the winter

Not many clubs are running trains at this time of year but they are still busy...

COMPILED BY ANDREW CHARMAN

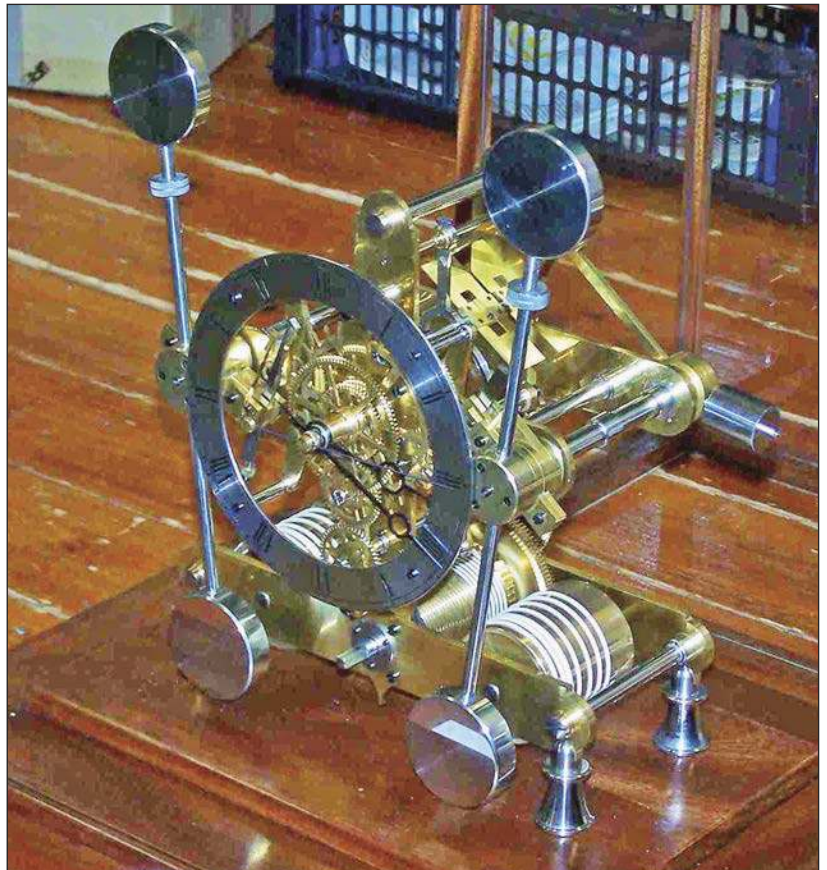
These notes are being written while much of the country is on its Christmas and New Year break – no rest for the monthly magazine editor! Browsing through the usual selection of club magazines received at **EIM** Towers, it's clear that our model engineering societies have not exactly been resting on their laurels either.

Many clubs have been running Santa Special trains on their tracks, an excellent way of raising funds (on the somewhat larger Welshpool & Llanfair Light Railway where your editor is a Trustee, the Santa Special trains are the most important revenue producer of the entire year...). Others are cracking on with essential maintenance and in some cases expansion of their facilities.

Meanwhile a glance at our diary on page 42 reveals that one or two clubs will continue to run trains for hardy souls through the winter months of January and February. Which reminds me – some clubs have been very good at sending their 2019 calendar of events into the office in time for the new diary but I've also had to trawl many a club website to gather several of the important new dates. If you are responsible for a club calendar, please ensure you send in your listing as we like to give your events publicity in our diary pages – you might get prospective new members spurred into coming to your club by reading of a forthcoming event

RIGHT: This compound pendulum clock built by Dave Watts was the highlight of the recent Bradford exhibition. Photo: Bradford ME

BELOW: The Plymouth winter track refurbishment is being made a lot easier by mechanical assistance. Photo: PMS



in our pages. Remember too that we work a long way ahead – I was compiling the February diary in late December while most were getting over their festive excesses!

Staying put – for now

We start this month's round-up with some good news from the **Welling and District MES**. Back in July we reported in these pages that the club was facing looking for a new site after 41 years behind the electricity station at Falconwood, Kent, as National Grid required the site to sink a deep shaft for underground cables.

Thankfully the club's Fred Holdsworth has been in touch to tell us that it will be able to stay at the site for at least another year, as National Grid will not require the land to start tunnelling just yet. While obviously this still leaves the club with a lot of uncertainty, it does give them significantly more time to try and find a new site for their impressive track, which currently measures 1268 feet long with full electronic signalling, footbridges, a tunnel, a mini viaduct and level crossing.

So it's worth putting the club's running dates into your diary at what

will likely be the last year at Falconwood – they are 7th and 21st April, 5th and 19th May, 2nd, 16th and 30th June, 14th and 28th July, 11th and 25th August, 8th and 22nd September, and a final weekend on 5th-6th October featuring an open day on the Saturday.

Not much of an update on the ongoing efforts by **Bristol SMEE** to prevent being forced off their site by the city council. Negotiations over the lease of the Ashton Court Railway are still being discussed with Bristol City Council, with a major sticking point appearing to be parking for the members who turn out to run the line.

In the meantime an interim 'Tenancy at Will' document has been agreed, allowing the society to continue to run the line. However writing in the Christmas edition of the club newsletter *The Bristol Model Engineer*, chairman Norman Rogers highlights the aspect of the council's attitude and behaviour "that causes huge concern", which is a clear intention to find an activity on the site that will bring in a lot more money. As a result the club is undertaking extensive work to identify potential new sites should they be forced to



leave Ashton Court, and has asked members to assist them in the search.

On a different note, the club's railway manager Rebecca Strong reports on a recent holiday to Melbourne, Australia, where she rode on a 7¼-inch line, the Diamond Valley Miniature Railway. Given a seat of honour in the guard's van, Rebecca noticed that despite loudspeaker warnings, passengers still tried to lean out of carriages, pick up bits from the trackside and touch the tunnel sides; "No different from this country..."

The latest edition of the **Bradford ME** newsletter reports on the Society's annual exhibition in the Saltaire Methodist Church Hall on 25th November. This proved as enjoyable a social event as ever, though sadly the number of actual entries was significantly down, resulting in only six trophies being awarded. The last to be presented, the Amos Trophy, was awarded to Dave Watts for a superb compound pendulum clock that Dave made to his own design.

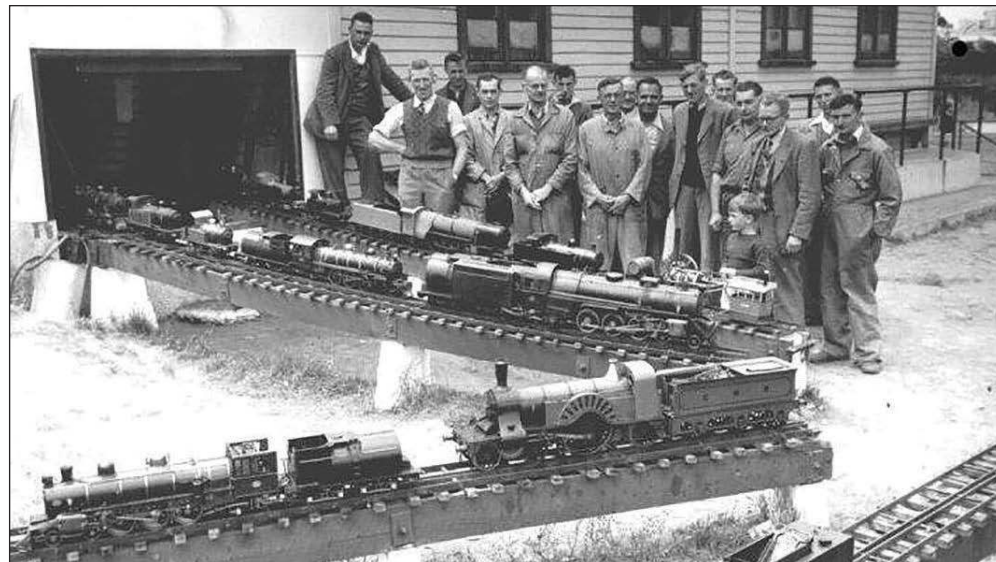
Criterion, the latest newsletter of the **High Wycombe ME**, reveals that the evening meeting schedule has been filled to May with an impressive list of talks. Your editor regularly gives talks to various organisations and knows just how difficult a task for a diary secretary organising a programme is, with many speakers booked up well in advance (I got my first request for 2020 this week...).

Bring in the bacon

A notable addition to the early season calendar for High Wycombe members are a series of five 'Bacon Butty' mornings. These are designed to allow loco owning-members to run their engines and hopefully non-owning members to also have a go. Steam and bacon of a morning, what could be a better combination?

Much winter work going on at the track site of **Plymouth MS** which as soon as the last running day of the season was completed started on an ambitious winter maintenance programme. This is focusing on a level crossing that has been seeing increased use in recent times as ever-growing modern cars cannot make use of an alternative bridge! So the crossing is being upgraded with new concrete while other work includes improving drainage in the steaming bay – members discovering on excavating the area that the pipe in the soakaway was actually two inches higher than the drainage pipe in the steaming bay, requiring any draining water to travel uphill...

To speed the work Plymouth members have for the second year running hired in a mechanical digger, but this year they also invested in two



weeks of service from a powered wheelbarrow. This has proven a real boon, especially when a builder's merchant delivered large bags of sand and gravel, 20 bags of cement, 11 lengths of pipe, 140 concrete blocks, reinforcing mesh and bar, totalling some 5378kg...

Olympic efforts

Talking of using earth-moving equipment... Last month we reported on efforts by members of the **North Wilts ME** to build a new tunnel at their Coate Water Railway near Swindon. They erected the steelwork for the tunnel, which is both long and curving, from effectively a flat pack. Well the latest edition of the club newsletter the *Coate Express* (a perennially light-hearted publication that we always enjoy in the **EIM** office...) gives a strong clue to the challenges faced by those working on the earthworks to bury the steel, by announcing a new sporting event, dubbed the 'Senior Olympics for competitors over 60'.

"The first event, already trialled", reports the newsletter, "will be the Dumper Truck Overland Obstacle Race. This will be a timed race with points deducted for hitting trees, rolling the dumper and getting stuck."

"Competitors will attempt the course in three trucks. Each truck will have at least one fault, and they will all have different pedal arrangements."

As we endure the depths of winter and what is generally regarded as the closed season in the UK, it's easy to forget that in other parts of the world it's closer to summer. The latest edition of *Conrod*, the newsletter of the **Otago ME** in New Zealand, reports on preparations for the club's annual exhibition, the Festival of modelling in St Kilda. Impressively the event lasts a full week, this year's open all day on Saturday and Sunday 3rd and 4th of February, in the

evenings between 6.30pm and 8.30pm through the week, all day on Tuesday (known as Watangi Day) and again two more full days over the final weekend of 10th-11th February.

Details in *Conrod* of the festival and the usual appeals for help are illustrated with some evocative pictures from past shows in the 1950s, the one reproduced on this page showing an impressive line-up of locomotives with their proud builders. Sadly having just been to Taiwan on behalf of the full-size steam railway I work on I don't think the **EIM** editorial budget will stretch to attending this particular festival!

Picnic trains

Staying outside the UK for a moment, the latest *Maritzburg Matters* from the **Pietermaritzburg ME** in Natal, South Africa, reports a very healthy series of running days on the society's track (an impressive setup that runs to just under a kilometre) with between 800 and 1000 tickets sold at each.

Pietermaritzburg chairman Martin Hampton describes this figure as "very encouraging" and in need of further support, as are an increasing number of picnickers at the running days. A family picnic with miniature trains on hand – sounds like the

ABOVE: A superb shot from the Otago ME as it looks forward to its annual show, recalling the 1950s version. Photo: Otago ME

BELOW: Mechanical assistance part 2 – in use by the North Wilts club and apparently encouraging new Olympic sports... Photo: North Wilts ME





perfect way to weekend relaxation...

Your editor always appreciates the various clever dodges that appear in the club magazines and there is one in the *Maritzburg Matters*, revealing a simple, inexpensive way of ensuring correct angles when sharpening drill bits, in turn taken from a website called *Krafty Farm Assistant*.

The trick is to take two hex-headed bolts and nuts and to mount them in a piece of offcut steel or timber so that two of their edges touch (see photo). The bolts can be welded to ensure they don't move. Following careful sharpening on a bench grinder the drill bit is tried in the angle between the bolt heads and if at a correct angle it will fit tightly between them – simples. The accuracy depends on how accurately the two bolts are placed together but as the newsletter suggests it is better than relying on one's eye as a guide...

On the subject of shows, this issue hits the newstands just ahead of the **London Model Engineering Exhibition** on 18th-20th January, at which I hope to meet many readers. As mentioned in this month's editorial on page 3 I'll be somewhat more confident attending this show at Alexandra Palace, having been very new in the editor's hot seat when at the 2018 version.

Some purists might not appreciate the more wide-ranging remit of the London show compared to say its sister Midlands event, but for me this adds to the appeal as I enjoy looking at any sort of model beyond the core engineering subjects, be they boats, aircraft or plastic kits, the selection on display at London always built to a



ABOVE LEFT:

Drill-sharpening dodge in the latest edition of *Maritzburg Matters* from South Africa.

ABOVE RIGHT, RIGHT:

The London show features plenty of model engineering but also some impressive wider modelling. Photos: Andrew Charman



BELOW: And finally, this is certainly wider modelling... Squeezed out of John Arrowsmith's report from Germany this month (pages 28-31) was this amazing model of Concorde being built by Otto Widloither. It will weigh in at 149.5kg and will be powered by four turbine engines.

very high standard. And this year we even have a display focusing on the engineering-themed fashion of Steampunk, which should be interesting to say the least...

The other show to remember at this time of year, of course, is the Manchester event, **MMEX** on 23rd-24th February – another which I'll hopefully see many readers at.

Digital future

Holding the *Gazette* of the **St Albans & District ME** is something we won't be doing much longer, as from April the club will be switching to an online-only digital version. Such moves are understandable – the potential cost savings are considerable and by far the majority of magazines and newsletters received in the **EIM** office now come by email. But for this editor who started his journalism career with a manual typewriter, the slow decline in the printed word is still somewhat sad. I'm glad we still very much have printed word to enjoy in **EIM** – unless you are reading the digital edition of course, which admittedly I find very convenient especially when searching for something in a back issue...

In the December issue these pages featured the announcement of a brand new, not too serious model engineering society, **The Itinerant Model Engineers** or TIME for short – described as “a Refined Gentleman's Club for the Confused and Confounded Model Engineer.” We also commented that we hadn't actually been given any contact details or details of meetings...

Suitably chastened, Geoff Stait from TIME has got in touch to tell us that the group meets at The pipers Inn, 70 Bath Road (A39), Ashcott, Somerset TA7 9QL, on the first Thursday of each month at 7pm. Geoff adds that prospective new members will be very welcome to turn up at a meeting.

Keep the newsletters and journals coming in, and don't forget, if you have a particular item of news from your club that other model engineers would benefit from, whether it be a forthcoming event, expansion plans or simply a particularly impressive or interesting model completed by one of your members, all it takes is a few words and a picture sent into the editorial office to get it on these pages – the address is on page 3... **EIM**

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FEBRUARY DIARY

EVERY SUNDAY

(Weather permitting)

Bournemouth SME public running,
Littledown Pk, BH7 7DX, 11am-3.30pm

Canterbury SME (NZ) Public running,
Halswell Domain, from 1pm

Fylde SME Public running, Thornton
Cleveleys from 1pm.

Kings Lynn & District SME public running,
Lynnport Leisure, Greenpark Ave, PE30 2NB, 11am-3pm

North Wilts MES public rides, Coate
Water Railway, Coate Water Country
Park, Swindon, 11am-5pm

Rochdale SME public running,
Springfield Park, Bolton Road (A58),
Rochdale, pm

Southport MES Public running,
Victoria Park 11.30am – 4.30pm

Urmston MES Public running,
Abbotsfield Pk 11am – 3.30pm

Wirral MES Public running, Royden
Pk, Frankby, 1-3.30pm.

EVERY WEDNESDAY

(Weather permitting)

Bournemouth SME public running,
Littledown Pk, BH7 7DX, 11am-3.30pm

Harrow & Wembley SME members meeting,
Roxbourne Park, Eastcote, 2.30-10pm

Kings Lynn & District SME, public running,
Lynnport Leisure, Greenpark Ave, PE30 2NB, 11am-3pm

1 Portsmouth MES AGM, Community
Room, Tesco, Fratton Way,
Portsmouth PO4 8FD, 7.30pm

1 Rochdale SME meeting, Auction
night, Castleton Comm Cntr,
Rochdale OL11 3AF, 7pm

2 SMEE meeting, 'Early years of
aviation at Farnborough' by Graham
Rood, Marshall Hse, London SE24
0HW, 2.30pm

2 Tiverton MES Running day,
Rackenford, contact Chris Catley,
01884 798370

5 Canterbury SME (NZ) meeting,
Halswell Domain, 7.30pm

5 Romney Marsh ME meeting,
'Developments at Maxitrak' by Andy
Probyn, Rolfe Lane, New Romney,
TN28 8JL 7.30pm

6 Bradford MES meeting,
'Walschaert's Valve Gear, Piston
Valves and Superheaters' by Ron
Fitzgerald, Saltaire Methodist
Church, 7.30pm

6 Bristol SMEE AGM, Begbrook Soc
Clb, Frenchay Pk Rd, Bristol BS16
1HY, 7.30pm

6 Leeds SME meeting, 'It's About Time'
by Richard Hanes, Eggborough Pwr
Stn Sports & Leisure complex, DN14
0UZ, 7.30pm

6 Southport MES meeting, Rotten Row,
Southport PR8 2BZ. Evening

7 South Lakeland MES meeting,
Pavilion, Lightburn Pk, Ulverston,
7.30pm

7 TIME meeting, Pipers Inn, 70 Bath
Road (A39), Ashcott, Somerset TA7
9QL, 7pm

7 Wirral MES meeting, WI Hall,
Thornton Hough, 7.45pm.

8 Tiverton MES Quiz Night, Old
Heathcoat comm Ctre, contact Chris
Catley, 01884 798370. 7.30pm

9 SMEE Basic Training Day 1, Marshall
Hse, London SE24 0HW, 2.30pm

11 Otago MES (NZ) general meeting, 1
John Wilson Drive, St Kilda, Dunedin,
7.30pm

12 Isle of Wight MES Boat boys meeting,
Broadfields, Park Road,
Cowes, PO31 7NN. 10am-noon

12 Northampton SME AGM, Delapre Pk,
Northampton, NN4 8AJ, 7.30pm

12 Romney Marsh ME members' social
afternoon, Rolfe Lane, New Romney,
TN28 8JL 2pm

13 High Wycombe MEC meeting, '50
years of road steam' by Chris Gooch,
Rossett Hall, 38 New Pond Rd,
Holmer Green HP15 6SU, 8pm

13 Southport MES meeting, Bits &
Pieces, Rotten Row, Southport PR8
2BZ. Evening

14 Worthing SME meeting, 'Scams &
rip-offs' by PC Richard Moores, Field
Pce, Durrington BN13 1NP, 7.30pm

15 Rochdale SME meeting, Castleton
Comm Cntr, Rochdale OL11 3AF, 7pm

16 Gauge 1 MRA Bacon Butty Bash,
Durrington Village Hall, Salisbury SP4
8AD, 10am

16 Isle of Wight MES members day,
Broadfields, Park Road, Cowes, PO31
7NN. 9.30am-4pm

17 Tiverton MES Running day,
Rackenford, contact Chris Catley,
01884 798370

19 Grimsby & Cleethorpes MES AGM,
Waltham Mill, DN37 0JZ, 7.30pm

19 Romney Marsh ME meeting,
'Engraving & 3D printing' by Jeff
Gibson/Dave Draycott, Rolfe Lane,
New Romney, TN28 8JL, 7.30pm

**20 Bristol SMEE 'Transforming Western
Region' by Paul Stanford**, Begbrook
Soc Clb, Frenchay Pk Rd, Bristol BS16
1HY, 7.30pm

20 Leeds SME meeting, 'Three short ME
topics', Eggborough Pwr Stn Sports &
Leisure complex, DN14 0UZ, 7.30pm

20 Southport MES meeting, Screw
cutting by Jim Small, Rotten Row,
Southport PR8 2BZ. Evening

21 Wirral MES meeting, 'The Chester
Birkenhead Railway' by John Ryan,
WI Hall, Thornton Hough, 7.45pm.

23 SMEE meeting, 'Electric motors for
traction applications' by Bob Walker,
Marshall Hse, London SE24 0HW,
2.30pm

23 Manchester Model Engineering

24 Exhibition, Queen Elizabeth Hall,
Oldham, <http://mmex.co.uk>

24 Otago MES (NZ) running day, 1 John
Wilson Drv, St Kilda, Dunedin, 1.30pm

26 Romney Marsh ME members' social
afternoon, Rolfe Lane, New Romney,
TN28 8JL 2pm

26 Wigan MES meeting, Ince Methodist
Church, Manchester Road, Ince,
Wigan, WN1 3HB 7pm

27 Southport MES meeting, Darjeeling
Himalayan Railway by Derek Pratt,
Rotten Row, Southport PR8 2BZ.
Evening

28 Worthing SME AGM, Field Pce,
Durrington BN13 1NP, 7.30pm

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

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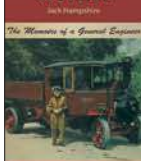


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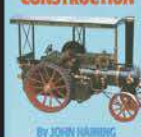


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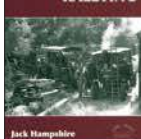


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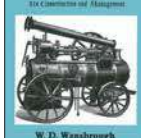


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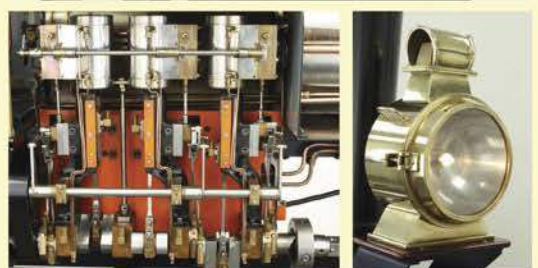
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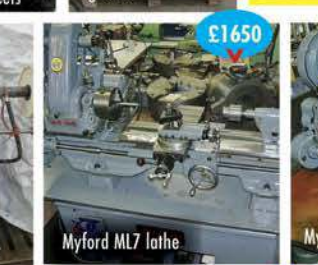
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