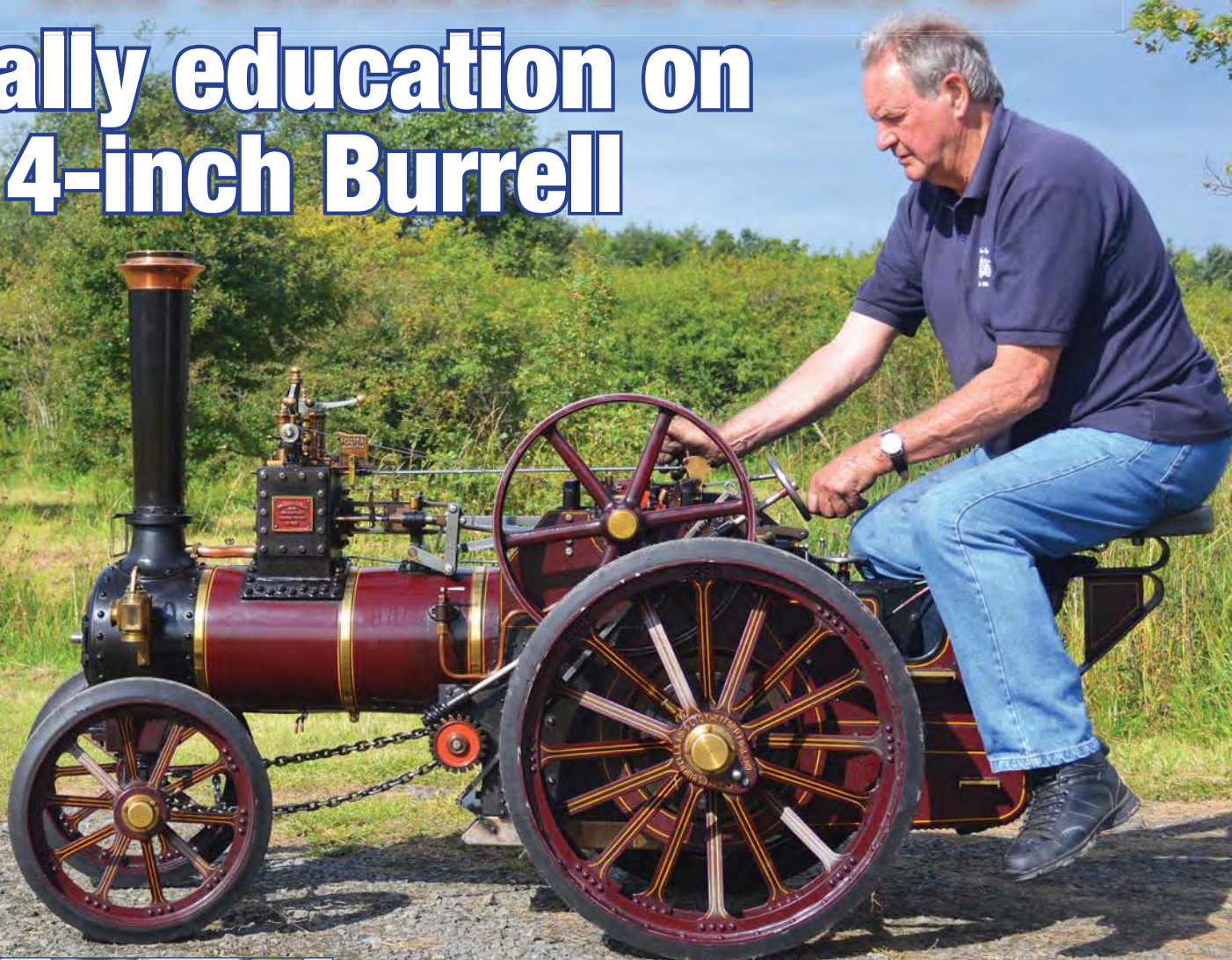


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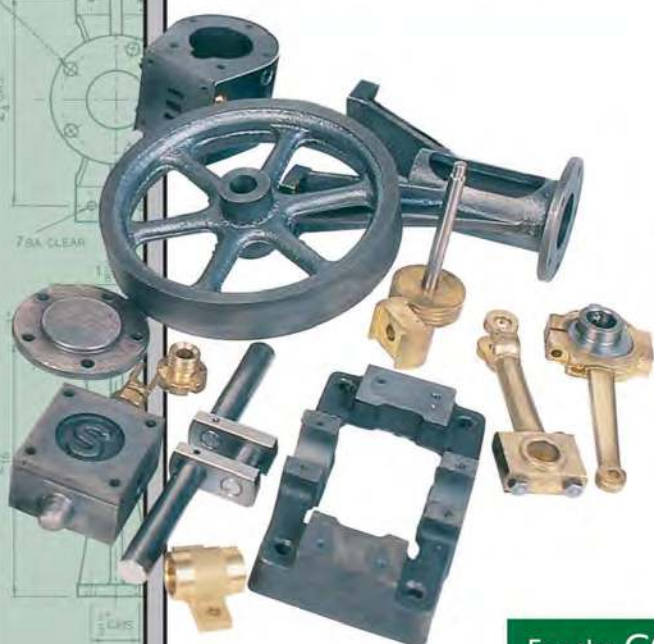
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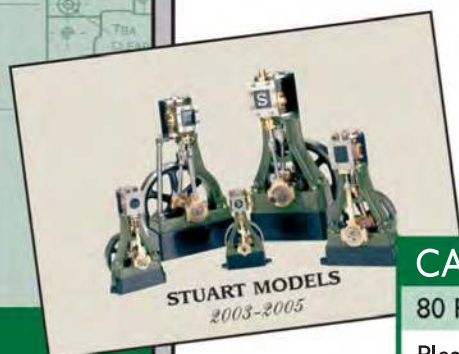
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FRONT COVER

Len Witt's first steam engine build took him up several scales and into a world where he had to learn to drive. The full story starts on page 29. Photo: Alan Barnes

EDITORIAL

Welcome a new year, and a new project?

A warm welcome to the January issue of **EIM** and Happy New Year! Though I do admit to finding saying that slightly strange as the vagaries of production schedules, especially around Christmas, mean that I'm actually writing these words on the second day of December, with all the festive madness only just beginning to ramp up...

A new year means new year's resolutions, and there's no doubting what's top of the list at **EIM** Towers – get into the workshop! A major problem with editing a model engineering magazine is seeing all the efforts of our readers in their workshops, turning out fine models, without doing any actual model engineering one's self! The urge to create swarf is strong and this editor is determined that the first job for the new year will be to rescue the workshop (I think I've said before that my workshop is in a garage, and the combined efforts of two of my children leaving home and then moving home, one of them twice, means that my prized lathe, drill et al are currently inaccessible behind a horde of detritus; "Dad, can we just store this here for little while as there's no room in our new place..." First outlay in 2020 will be on a skip...).

Nothing makes one want to get on the tools more than wandering a show and seeing the efforts of others, and of course we've just had a major show... In this issue John Arrowsmith concludes his 2019 Midlands report and there was so much excellent stuff on the club stands that we've devoted the *Club News* pages to their efforts – the normal *Club News* will return next month, well so long as some of you send me copy, and especially some pictures.

Looking at the modeling excellence on display often sparks a comment of "Wonder how they did that?" Which is my way of making another appeal to readers to write up your project for others to enjoy. Appearing in these pages puts your pride and joy in the public eye as well as helping recover some of the cost, because we do pay for features. Andrew Strongitharm's 'Dougal' build, the first series I commissioned on taking the helm of **EIM** in March 2018, is nearing its conclusion and while we do have another major loco build series lined up, we'd like to see more – especially from some of the less widely covered subject matter, such as road engines, stationary engines, i/c, clocks... We'll watch the inbox in anticipation...

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An 11-inch Rotary Table

Rich uses a car brake disc as the basis for creating a useful piece of workshop equipment.

BY RICH WIGHTMAN

Now that I am retired I have a little more time to spend on my main hobby of model engineering and to write a few articles. Over the past 12 years five features of mine have appeared in this magazine, not a high output but hopefully they have been of interest to my fellow readers and enthusiasts.

It's not easy to find the time to do everything one would like. There always seems to be something cropping up to block the escape route to the workshop. In the last 12 years three granddaughters have appeared. They love going in my workshop but mostly it involves lots of paint, glue, Play-Doh and of course mess. But they must be encouraged to use their imaginations and gain a few skills.

My eldest granddaughter Frankie who is nine, under strict supervision and wearing the correct clothing, eye protection and such, has progressed to a small cordless drill and the hot glue gun. Lots of bits of wood, lots of waste and again lots of mess.

Anyway onto the subject of this article, an 11-inch rotary table.

Over the years a need to machine parts with a large radius has cropped up. Mostly I have cobbled something together and satisfactorily machined the part but always with a makeshift bit of kit, only of use for that specific part or job. Often it has taken the best part of the day to make the tool to machine a part that then has taken less than half an hour to make. It is great fun and a challenge but also a great waste of valuable workshop time.

Rotary tables are the answer to machining most things circular and with a radius. I have a 4-inch rotary table fitted with a four-jaw independent chuck that gets a lot of use. I have managed to accurately fit the four-jaw to the rotary table so I am



ABOVE:

Rich's three rotary tables – the one built in this article is to the right.

For the captions to construction photos, refer to numbers in the text.

All photos and diagrams by the author

reluctant to remove it for other types of work. However a 4-inch rotary table does have its obvious limitations. What I needed was another table.

Decent rotary tables of 6 inches or more don't come cheap, even secondhand on auction sites and the weight means high postage charges. Very rarely is the seller within collection distance.

So much so that a few years back I set to and made myself a 7-inch rotary table. This was a great success and a very useful bit of kit. It's accurate enough for my needs and has coped with all the jobs I have asked of it. But one weakness is the worm and gear which I made myself. It's not really man enough for the size of the table so I have to use it with care. But that's a story for another day.

About two years ago I embarked on my first loco build, 'Conway' by Martin Evans, believing that I now had the necessary skills to tackle a large project. I have had the dreaded steam bug for a long time so I thought it's about time to have a go. The loco is a 3½-inch gauge 0-4-0 and is now about 90 per cent there (**Photo 1**).

I had no particular plan or order of construction but made parts as and when time and materials were available. Castings are of course available at a price but I decided to fabricate as much as possible.

When making the reversing stand I needed something on which I could machine the 3¼-inch radius. The 7-inch rotary table was perfect for this job and performed the operation with no issues. **Photo 2** shows the

setup, **Photo 3** the machining.

When it came to the expansion links the same problem arose. I now needed something with which to machine the outside edge of the link to a 4 9/16-inch radius (9⅝-inch diameter) which clearly exceeds the 7-inch rotary table. At the same time another job came up, not associated with the loco build, which required machining something like a 10½-inch diameter. I needed to make another piece of kit that would do both jobs. Time to get my thinking cap on and give the old grey matter some exercise.

A table of 11 or 12 inches would be ideal but as mentioned before the cost of even a secondhand one of that size would be far beyond my pockets.

After some brainstorming I came up with this idea, an 11-inch hand-operated rotary table. It was while using my hand-operated ball turner on the lathe that I noticed how easy it was to operate.

My table is based around a car brake disc, 11 inches in diameter. This one had been kicking about the bench at work for some time and was surplus to requirements so was duly brought home to my bench. A quick glance on eBay shows that such discs can be obtained for under £20.00 including the postage, but they are quite heavy, visit your local parts supplier or local garage where they should be cheaper. Another look on eBay shows a mild steel disc 300mm diameter x 15mm thick at £50.00, compared to the cost of buying a brake disc ready machined for £20.00 or less.

Brake discs come in a variety of





sizes so choose one that suits your machine and requirements. Try to choose one that has a low profile as I think it would be more rigid than one with a higher profile and would help to keep the quill to table distance to a maximum – some discs sit quite high as they incorporate a drum for the handbrake shoes. The disc I used is from the rear of a Ford Mondeo.

Quality starting point

Brake discs are exceptionally well machined – obviously they have to be or all sorts of braking problems will occur. If there is the slightest run out judder, uneven braking and pedal bounce are a few of the problems that will be experienced. I doubt such accuracy could be achieved in the home workshop – my beloved Myford ML7 could just about cope with 9 inches if the faceplate were used in the gap so 11 inches is out of the question.

Having reached the basic idea of how I would make this bit of kit the next job was to go through the 'That'll come in handy one day' box. I'd like to mention at this point that it doesn't bother me using and mixing imperial and metric materials and tools. I use whatever comes to hand and suits the job so my apologies to those who are only conversant with one or the other.

My milling machine is an X3 supplied by Arc Euro Trade, (0116 269 5693, www.arceurotrade.co.uk). I have no affiliation with the company apart from being a satisfied customer.

The mill uses 10mm studs in 12mm slots and the table described here was built to fit this machine, so if

yours is a smaller machine such as the X1 or X2 which uses 6mm studs you will have to drill to suit.

I have not provided any detailed plans as I mostly made the design up as I went along and worked with materials that came to hand. I will mention a few sizes in the text which will hopefully suffice.

The basic parts consist of:

- 1) The brake disc
- 2) A bit of 10mm thick steel plate
- 3) A bit of 6mm steel plate
- 4) A bit of 1/4"-inch thick brass plate
- 5) A bit of angle iron
- 6) A length of steel bar
- 7) A block of aluminium
- 8) A bit of 20mm thick MDF
- 9) Various nuts, bolts, screws and washers.

Starting with the brake disc, the central hole has quite a deep chamfer. Not all brake discs are like this but if yours is the chamfer needs to be removed (Photo 4). The disc was way too big to fit in my Myford lathe so I turned up a scrap of aluminium to a tight fit in the disc and centre drilled it (Photo 5). This enabled me to centre it in my milling machine under the quill (Photo 6), then to machine away the chamfer with a boring head (Photo 7). The hole size is not critical as the 6mm steel plate will be machined to suit. Apart from a few tapped holes that's all the machining the disc needs.

Next the 6mm steel plate has an 8mm hole drilled in the centre and then the corners knocked off in the band saw. For jobs like this I use a scrap of wood and a good size wood screw (Photo 8). Mount the 6mm steel





disc on a mandrel with an 8mm bolt and a large thick washer and turn to size. Aim to get a really good close fit in the disc (**Photo 9**).

Countersink the central hole until an M8 countersunk socket head cap screw sits just below the surface (**Photo 10**). The brake disc is 6mm thick at the hole so I skimmed a few thou of the 6mm steel disc so that it sits just a gnat's (gnat's is a well known engineering technical term for a few thou) below the surface. That's it for this part.

The 10mm thick steel base plate is next. Drill and tap 8mm in the centre. Machine two slots, one each end for mounting to the milling machine table. In my case I used a 1/2-inch cutter to produce the slots. Use whatever suits the machine you intend to use (**Photo 11**).

Assembling the table

Time for a trial assembly – bolt the 6mm steel disc to the 10mm base plate with an M8 countersunk socket head screw and drop the brake disc on (**Photo 12**). Bolt the base plate to the milling machine table and apply a liberal coating of oil. If all is well the disc should turn freely with minimal play. You can watch a short video of yours truly trying the fit on Youtube at <https://youtu.be/zCeSvCy-9Pk>

To hold it all together I used a bit of 1/4-inch brass plate which is firstly cut roughly to shape on the band saw (**Photo 13**). Then it was finished to size by filing and on the disc sander (**Photo 14**). Aim to get a good fit inside the brake disc (**Photo 15**).

I just managed to get the disc into the lathe chuck to centre-drill it (**Photo 16**). Mark out for four bolt holes and drill 6mm (**Photo 17**). Drop the brass disc into the brake disc and using a transfer punch, mark the four holes onto the steel disc (**Photo 18**). Remove the steel disc, drill 5mm and tap M6. If you look closely at the photo you will see that the nearest hole has been stamped with a No. 1. The corresponding hole on the brass disc is likewise stamped with the No. 1 to ensure the parts are fitted in the correct position (**Photo 19**).



The parts are fitted together with four cap screws. I originally assembled it with four short lengths of spring to apply pressure but leave the table free enough to turn (Photo 20). I later changed the springs for spring washers as a small amount of lift could be detected and they worked much better (Photo 21).

The rotary table can now be assembled with plenty of oil (Photo 22). Centre the table under the milling machine quill with a centre in the brass disc (Photo 23). Then tighten the nuts that hold the base plate to the milling machine table (Photo 24). An indelible pen is used to write some information on the inside (Photo 25). Move the milling machine table over and drill and tap four M6 holes in the face of the disc (Photo 26).

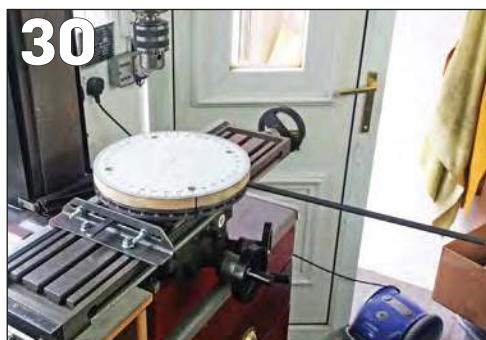
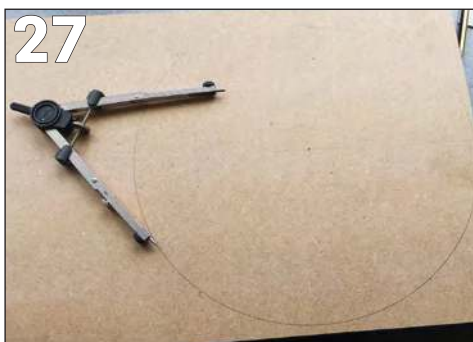
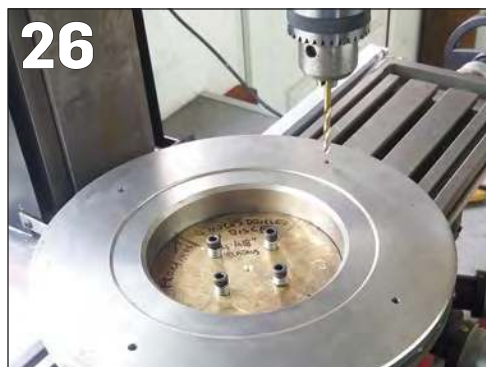
Mark out an 11-inch circle on the piece of 20mm thick MDF (Photo 27) and cut out with a jigsaw. Finish the edge on the disc sander. Drill four 6mm holes to match the four holes tapped in the disc and countersink. Fix the MDF to the brake disc with four countersunk socket-head screws. As a bit of a guide I printed out a protractor and glued it onto the MDF. The next time I will also print ever decreasing circles which will aid when mounting the work piece. Because the table is larger than A4 paper size I had to print out on two sheets of paper and make a joint across the centre.

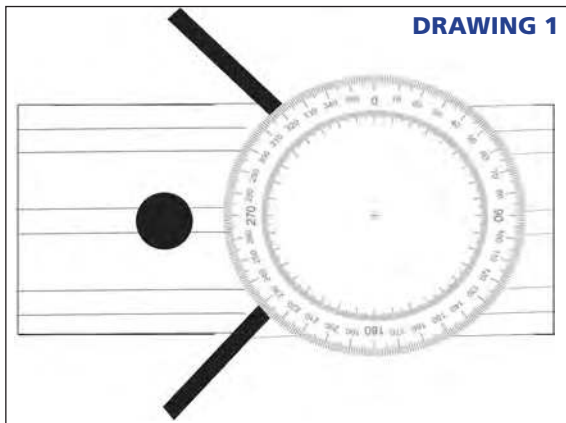
While the rotary table is centred under the quill bring it down to press a centre hole in the MDF.

Adjustable stop

For the job in hand, machining the expansion links, I have made an adjustable stop. On the underside of the disc drill and tap two holes for M6. Drill two corresponding holes in a short length of steel bar and bolt on (Photo 28).

A length of angle iron has two M10 holes drilled on one face to match the T-slots of the milling machine table. The other face has a slot milled to match the height of the stop bar (Photo 29). Two nuts and bolts are fitted into the slot to provide adjustable stops (Photo 30). A





modification for larger work pieces will be a single post fitted into one T-slot and two steel bars fitted to the disc something like [Drawing 1](#).

The operating handle is a steel bar ground at one end to fit into the vents in the disc, also shown in Photo 30.

To lock the table a post of aluminium is fitted into a T-slot, cross drilled and tapped M8. An M8 cap head is modified with a T-bar and a soft aluminium pad fitted ([Photo 31](#)). That's about it for the construction.

In practice the table works exceptionally well and machined the expansion links with ease ([Photo 32](#)). To save time marking out I print out exact size drawings of the part required and glue them to the material, in this case 1/4-inch x 1 1/4-inch gauge plate. The rotary table is centred under the quill. The Y axis is moved over 4 9/16-inch.

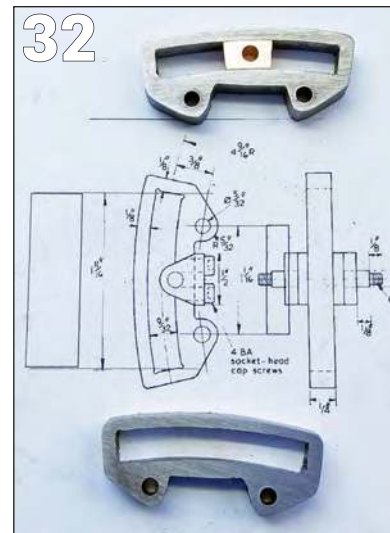
Place the blank on the table and bring the quill down so that the point of the centre presses down onto the

"It's always satisfying to make a bit of kit that works and in this case it works very well..."



blank at the required position. Screw the blank to the table. Raise the quill a little and turn the table back and forth and set the stops. Drill the blank at each end then machine away with an end mill ([Photo 33](#)). It's surprisingly easy to turn.

To give you a better idea of the size and as a comparison the heading to this feature shows all three rotary



tables on the mill. It's always satisfying to make a bit of kit that works and in this case it works very well and has been successfully used several times on other jobs. I hope you find this article useful. **EIM**



PHOTO CORNER



Matt Ditch, a regular contributor to [EIM's](#) sister magazine *Narrow Gauge World*, took these photos at the 7 1/4-inch gauge Beamish Cog Railway in County Durham – dubbed the world's first 7 1/4-inch gauge rack railway and set within the grounds of the living history museum. Construction of the Koppel at right in the main picture was serialised in [EIM](#) some years ago. These are superb examples of model engineering – a glance at the Wren top right and you could easily think you were looking at a full-size locomotive...

Making bunker corners

John concludes his series for workshop newcomers by tackling a major cosmetic issue.

BY JOHN SMITH

Here's this month's confession. I've always thought of metal forming as a black art best left to experienced coppersmiths. When it came to the bunker corners on the GWR 1400 class, it took me six months to even pluck up the courage to have a go, and that's after Steve Carter, another builder of the 1400 who is ahead of me in the construction despite starting 10 years later, kindly lent me the former he had made for the job (**Photo 1**).

The principle is simple – you clamp the brass sheet blank between the former and the $\frac{1}{4}$ -inch mild steel plate, hold the assembly in the vice and bash the blank. Steve's model is shown in **Photo 2** (It has since been painted.). His work rate is phenomenal; I'm sure the loco will be in steam before very long.

The reason for writing this Tip is that I would have found it really useful, so others might too! I had a thousand questions, including:

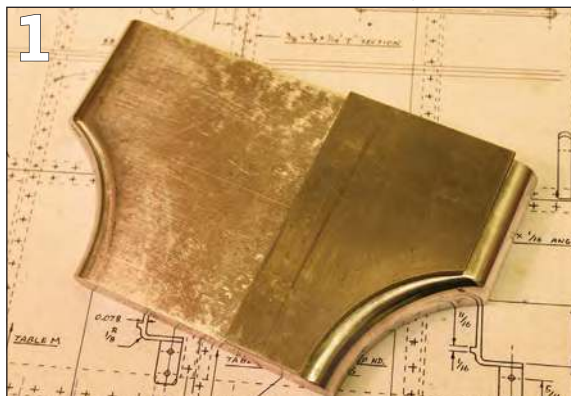
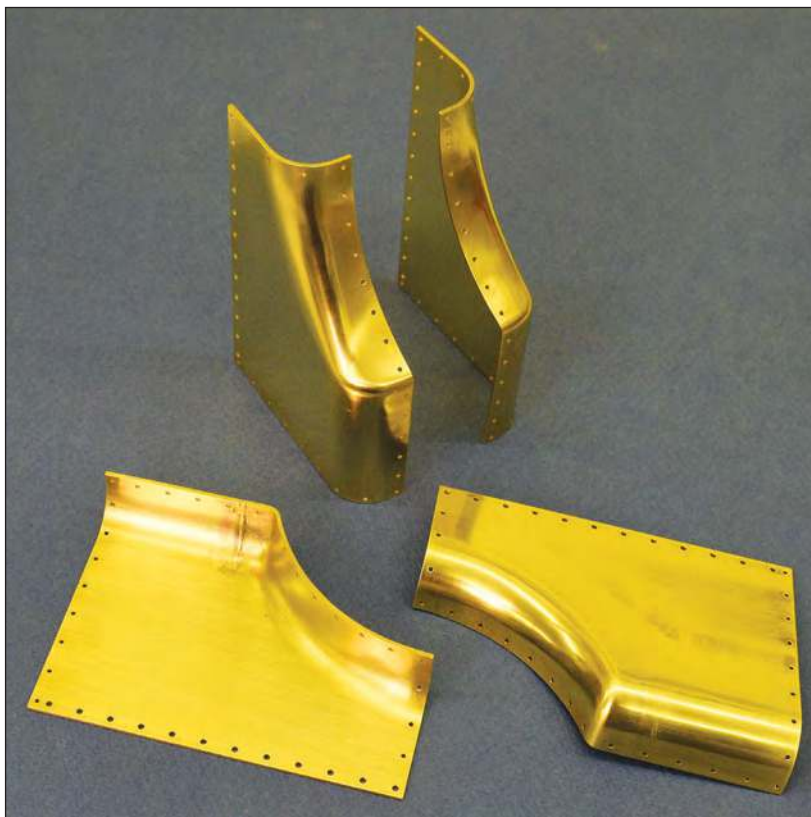
- 1) How many times can I hit it before it needs annealing again? Five? 10? 20?
- 2) Where do I hit it? Do I stroke the

RIGHT: An excellent pair of finished bunker corners plus two spares – vital elements to get right...

PHOTO 1: John was fortunate to make use of a former loaned by a fellow builder.

PHOTO 2: Steve Carter's 1400 class is making good progress.

PHOTO 3: John had no shortage of suitable forming tools to hand...



edges or do I hammer at the points where it nearly touches the former?

- 3) What type of hammer do I use?

I plied both Steve and Trevor Tremblen (a master coppersmith) with questions and made a start. I always like to have the right tool for the job so I assembled an arsenal of weaponry to attack the brass (**Photo 3**).

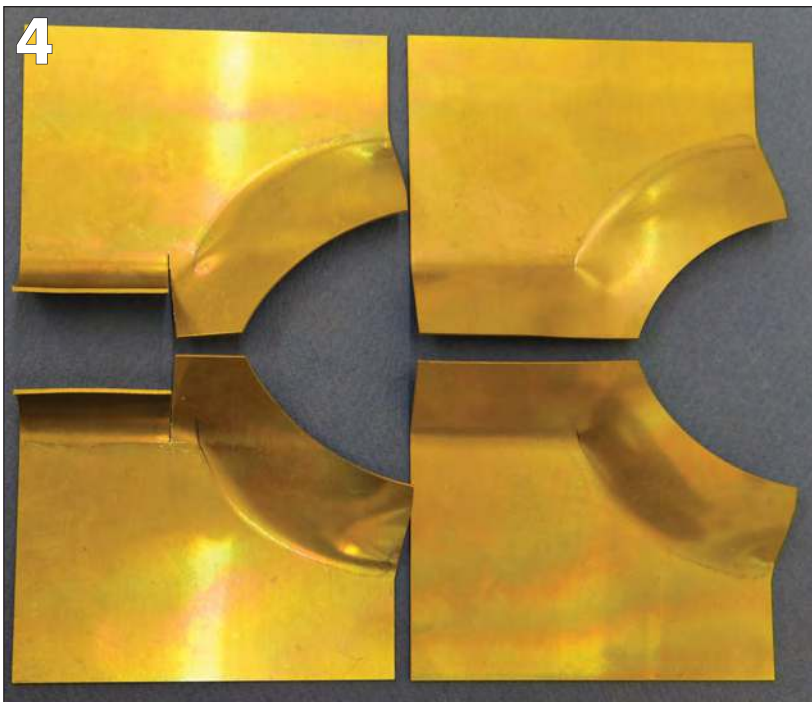
I can tell you that the Thorex 07-410 plastic hammer with a weight of 450 grams and a face diameter of $1\frac{1}{4}$ inches worked best for me. This is the smaller of the hammers with

orange plastic ends. And you basically do hit the very edge of the blank a number of glancing blows to persuade the metal to start its journey around the former – and 10 blows between anneals is probably the maximum. When the metal is approaching the former, you can bash it directly against the former to force it tight to said former.

The first task was to master the annealing of brass sheet. We've covered this in a previous Tip (**EIM** July 2019), so we know that the best



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**PHOTO 4:**

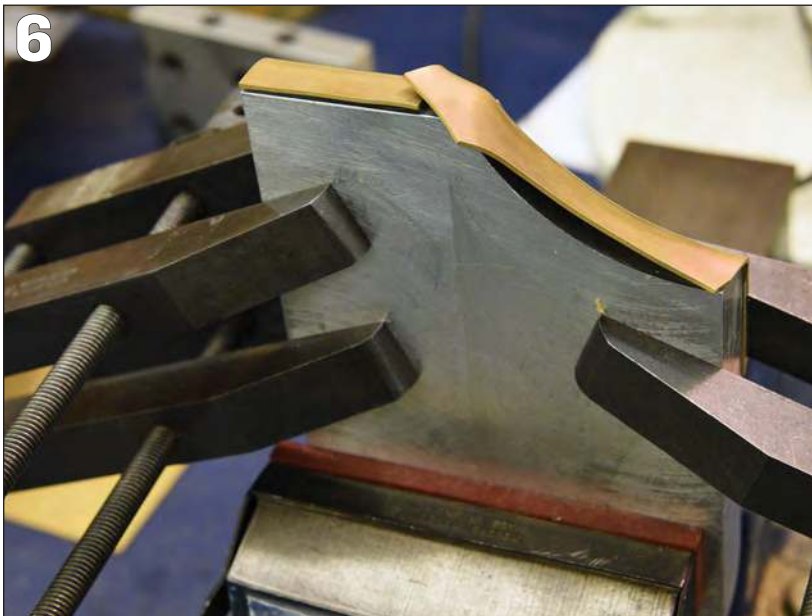
First efforts at bending the corners – the shapes are appearing and no sign of feared tearing.

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**PHOTO 5:**

Initial setup, blows struck away from person doing the hammering.

6

**PHOTO 6:**

Later method, hammer blows towards user to visually monitor the progress on curvature.

PHOTO 7:

Making further progress, the metal now overlapping.

PHOTO 8:

Excess metal removed and final shape beginning to appear.

PHOTO 9:

Corner ready for silver soldering – note shaped brass shim.

All photos in the feature by the author

approach is to get the brass to black heat (the very dullest of dull reds) and that the middle of the night is the time to do it! I like to 'soak' the brass with heat for a minute and then let it cool naturally.

Two methods

Trevor had suggested that I might have to make a saw cut in the brass and silver solder the gap after forming. It made sense that the saw cut should be mid-way between two rivets. I decided to try two different tactics. For one left-hand corner and one right-hand corner, I would saw the material before I started hitting it; for the other two corners (I always make a spare), I would delay sawing until the material had formed a little around the corner.

The reason for the latter approach is that I was worried that the material might 'tear' at the end of the saw-cuts. I used a 'thin saw' made in Japan; it has a blade thickness of just ten thousandths of an inch.

Photo 4 shows the corners after the first few rounds of hammering. The material had not torn at the end of the saw cuts and all four blanks were taking up the desired shape nicely. I sawed off a tiny sliver of brass where the two sides of what would become the soldered join were touching. It was time to anneal the blanks again.

During the next round of bashing, the brass fought back strongly. It did not want to bend at the corner and I had to use a lot of persuasion. It was time to apply the thin saw to the uncut blanks. After annealing it was easy to bend the brass around the upper curvature (above the awkward corner) on the newly-sawn pieces and I made some progress towards achieving the lower curvature, but the metal in the middle of the lower curvature really did not want to move closer to the former and was getting very tight. Time to reach for the propane torch again.

Visual progress

Up to this time, I had clamped the former to an angle plate held in the vice and pushed/hammered the metal away from me around the former (**Photo 5**). From this time on, I mounted the former directly in the vice and pushed the metal towards me (**Photo 6**). That way I could see how well the metal was approaching its final shape.

By this time, the metal above the saw-cuts was well-overlapped by the metal below the saw-cuts and I was getting cautiously optimistic that I might actually succeed in making these things. **Photo 7** shows the corners at this stage.

Steady progress was made, the metal approaching the former on the lower curvature quite nicely. It was time to saw off the excess material at the join. I also sawed off some of the excess metal along the lower curvature, leaving $\frac{1}{16}$ -inch to be milled off. **Photo 8** shows the corners at this stage.

After annealing and bashing a few more times, the metal in the lower curvature was almost touching the former, but the gap at the join was alarmingly large. I worked a domed punch along both sides of the join to see how easy it would be to close the gap. The answer? – not very, without creating an unsightly valley. However, a cunning plan was forming. Would it be possible to fill the gap with a brass shim and silver solder it in place? Two joins rather than one!

After one more round of annealing and bashing, the metal was tight to the former at the corner and all the way round the upper and lower curvatures. It was time to silver solder the join. I made some small brass 'sacrificial clamps' to hold the two sides of the join in alignment for soldering. These were just pieces of $\frac{1}{8}$ -inch square brass with a saw cut in the middle of one side. After soldering they were milled off with the rest of the excess metal. **Photo 9** shows a corner ready for silver soldering; the shaped brass shim can just be seen.

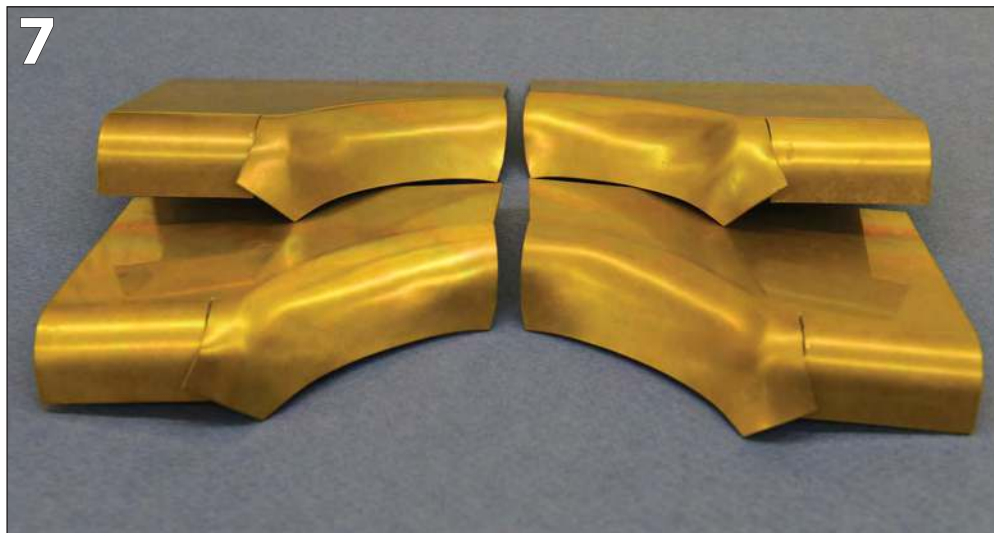
The silver soldering went well and, after cleaning off the flux in hot citric acid, it was clear that all of the joins were perfect. The excess shim on the outside of the corners was removed by filing; that on the inside was ground off with a Dremel. Finishing the corners to size was a simple milling job. The heading photo shows the finished corners – two for the model and two for the spares box.

Lessons learnt

I learned two important things from this project. Firstly, that it is possible to acquire a new skill, and a wonderful sense of achievement results when we do. Secondly, when it comes to metal forming, 'Softly, softly catchee monkey' works well. The more often you stop bashing and get annealing again, the easier the job becomes. Steve Carter annealed his bunker corners about 50 times and made them without the need for a single saw cut. **EIM**

■ With this issue John's series comes to an end and we hope readers, particularly workshop novices, have found much of use in his 25 widely-ranging tips. We are sure other readers have tips that their fellow builders will find of use, so why not send in your offering to the address on page 3?

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"I was getting cautiously optimistic that I might actually succeed in making these things..."

Scamp – minimal fun...

Having thoroughly enjoyed building the Scamp loco kit described last month, Dave needed some track to run it on in his garden...

BY DAVE BILLMORE Part Two of two



Last month I described my efforts at creating minimal gauge in my garden – and a reminder that Minimal is defined as genuine 12-inch to the foot narrow gauge (as opposed to a miniature of something else), in other words a tiny railway that does a real job of work, however modest, but on gauges less than Sir Arthur Heywood's 15-inch.

The immensely popular 7¼-inch gauge falls within this description and for my garden line I built one of the most successful kits to appear in recent years, 'Scamp', designed by Colin Edmondson and available in kit-form or as complete locos from CMD Engineering (www.miniature-trains.co.uk).

I was very happy with my Scamp,

All photos in this feature by the author

which is a four-wheeled petrol-electric 7¼-inch gauge locomotive with a Loncin or similar mower engine and a pair of matched 800w DC motors, one used as a generator and one as a motor. But now, of course, I needed some track for it to run on.

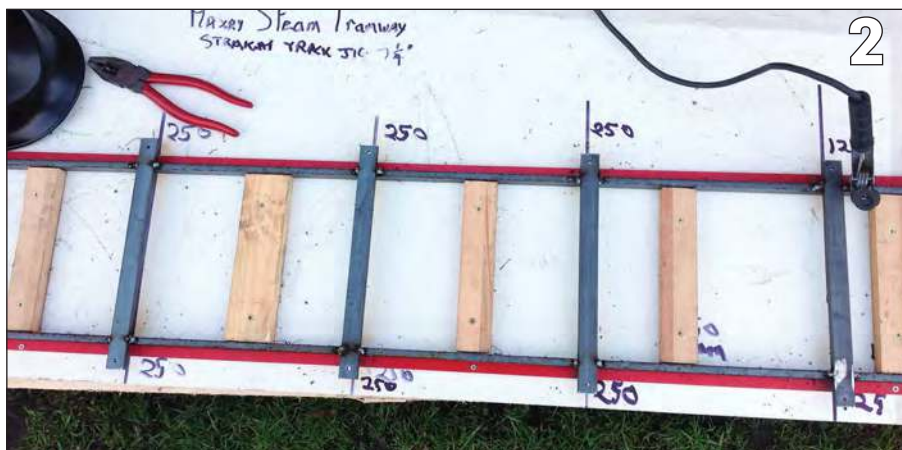
Simple structure

The track I have made uses steel bar, measuring 20mm x 8mm, for both rail and sleepers. I started off building straight panels in a jig as shown. This jib was knocked up from various pieces of wood and aluminium I had lying about.

The MIG-welder was used to tack the sleepers to the rail upside down. The track panel was then lifted out of the jig, turned over and each side of the rail welded to the sleeper. Depending on where in the garden the track is laid some of it has wooden sleepers under the steel ones, while other sections have been laid straight onto the ground.

So has the minimal concept been proven? It certainly works in our garden. Also taking the loco and wagons visiting is perfectly realistic, and minimalists are a friendly and practical bunch. It is all great fun, and the increasing number of Scamps built or building testifies to the popularity of the idea. Why not give it a go? **EIM**





HEADING: Tracklaying train – this particular rail is different to the norm – in order to reach all corners of the garden when required, some very lightweight track panels were made up using aluminum rail.

PHOTO 1: Setup for trackmaking, with the MIG welder being used to tack the sleepers in place – track section currently upside down.

PHOTO 2: Close-up of steel bar in straight track jig, upside down, with sleepers tacked in place. Sleeper spacing was 250mm, with 125mm each side of the joints.

PHOTO 3/4: Jigs for the holes in the rail and fishplates were made to ensure that sections were interchangeable. Fishplates were welded to one rail and bolted to the next.

PHOTO 5: Track gauges from box section with carefully cut slots at $7\frac{1}{4}$ -inch width were made, together with another set at $7\frac{3}{8}$ -inch for gauge widening on curves. Make sure they are clearly marked so they don't get mixed up or used on the wrong stretch of track!

PHOTO 6: The works train about to set off for the head of steel.

PHOTO 7: The head of steel somewhere in the orchard. Here the curves started. The bar rail was curved using a three-roller bender, then welded to the sleepers in situ.

The box section gauging bars are critical here. Scamps will go round six-foot radius curves, but mine are about ten-foot radius with $\frac{1}{8}$ -inch gauge widening. I used no ballast as I wanted the rails to disappear into the grass. We are not talking East Coast Main Line here, simply industrial practicality.

PHOTO 8: Combined with a portable turntable, which can be dropped onto the main line anywhere, temporary tracks can be laid on the garden for fruit harvesting and such like.



Gas-fired vertical boiler for the EIM Steam Plant

Soldering on the agenda for Martin this month as he continues the [EIM Steam Plant](#) project.

BY MARTIN GEARING – Part Fifteen of a series

The first step this month is to silver solder the Jet Holder/pipe. Make up two 0.7mm diameter rings of silver solder LT(55 per cent) to fit snugly around the 1/8-inch diameter copper pipe and one ring to fit around the 6mm diameter portion of the pipe end fitting. Cut a 100mm length of 1/8-inch diameter x 22SWG copper pipe and file the ends square removing all burrs.

Put the Jet holder and pipe in the pickle for 10-15 minutes, drain and rinse in clean water. Slip one 1/8-inch diameter silver solder ring over the end of the copper pipe. Apply flux to the 3.2mm diameter recess and around the ring and pipe.

Fit the copper pipe into the recess, pushing the silver solder ring into contact with the Jet Holder, and place on a heat-resistant block in the hearth, supporting the free end of the pipe so that it is vertical.

Direct the flame at the jet holder, occasionally passing up the pipe but avoiding direct contact with the silver solder ring. After the water boils off check to make sure the ring hasn't been moved up the pipe – if this is the case push it back down with the scratch stick.

When the silver solder flows pass the flame over the joint including the silver solder to ensure that the whole assembly is up to temperature and to assist full penetration.

When a smooth fillet has been confirmed, remove the heat and allow to cool before putting in the pickle for 10-15 minutes, draining and leaving to soak in clean water for 20-25 minutes before removing any flux residue with a stiff brush.

Silver soldering pipe assembly/End Fitting/Mount assembly

Put the End Fitting and End-fitting Mount in the pickle for 10-15 minutes, drain and rinse in clean water. Fit the End Fitting through the 6mm hole in the Mount after applying flux to both. Fit the 6mm diameter silver solder ring over the protruding stub of the End Fitting. Slip the 1/8-inch diameter silver solder ring over the end of the copper pipe at the free end of the Jet holder/Pipe.

Apply flux to the 3.2mm diameter

This series builds a boiler suitable for powering the [EIM Steam Plant](#), serialised in the magazine between October 2016 and December 2017

recess and around the ring and pipe. Fit the copper pipe into the recess, checking that both silver solder rings have a coating of flux. Place on a heat-resistant block in the hearth, supporting the Jet Holder end of the pipe so that it is vertical.

Direct the flame over the End Fitting around the Mount and occasionally up the copper pipe but avoiding direct contact with the silver solder rings, continuing as described for the Jet Holder. After pickling, soaking in clean water and removal of flux residue, make sure that the bore of the pipe is clear, and if necessary drill the ends out carefully using a 1.6mm (1/16-inch), drill blowing through to remove any swarf created by the drilling ([Photo B118](#)).

Silver Soldering Pressure Gauge U-tube Assembly

Take the banjo, a 70mm length of 4mm (5/32-inch) copper pipe, the union nut purchased (to fit the pressure gauge) and the U-tube Cone Adaptor made earlier (part B34). Check the free ends of the pipe are square and free from burrs, before putting in the pickle along with the cone and banjo for 10-15 minutes. Drain and wash in clean water.

Make up a ring of 0.7mm diameter silver solder LT(55 per cent) and fit it over one end of the copper pipe. Apply flux to the recess in the banjo and over the silver solder ring on the copper pipe and insert into the banjo recess. Push the ring in contact with the banjo and apply additional flux before setting on a heat-resistant block, arranging support to hold the pipe vertical.



Continue as for the Jet Holder and End Mount described previously. When you have confirmed that there is an even smooth fillet, remove the heat and allow to cool. Place in the pickle for 10 minutes, draining and placing in clean water. Leave to soak for 20-30 minutes, then remove all traces of flux with a stiff brush.

Pass the cone through the union nut and whilst pushing the cone to the back of the nut put a turn of copper or soft iron wire (about 0.5mm diameter) around the projecting tail of the cone tight to the back of the nut, bringing the ends of the wire up and over inside the union nut to prevent it sliding back down the adaptor.

Insert the cone end into the free end of the tube (attached to the banjo) about 3mm and with a pair of pliers gently grip the copper tube about 3.5mm from its end – apply enough pressure to distort the tube JUST enough to prevent the cone end dropping further into the tube.

Remove the cone end and slip on a ring of 0.7mm silver solder LT(55 per cent) made to fit snugly on the

PHOTO B118:

The gas jet holder and its connection after silver soldering operations have been completed.

All photos and drawings in this feature by Martin Gearing



2.6mm diameter cone end. Apply flux to the inside of the copper tube and insert the restrained nut/cone end with the silver solder ring in place, applying more flux around the ring and cone end.

Stand the banjo on a heat-resistant block and support the tube so that it stands vertical with the cone/nut assembly uppermost. Continue as for the Jet Holder and End Mount described previously.

When you have confirmed that there is an even smooth fillet, remove the heat. Allow to cool. Remove the wire before placing in the pickle for 10-15 minutes, draining and placing in clean water, then leaving to soak for 20 -30 minutes and removing all traces of flux with a stiff brush on removal (**Photo B119**).

The copper tube will be annealed because of the two silver soldering operations and will be easy to bend to a U-shape so that the nut and cone is about 10-15mm higher than the centre of the banjo fitting.

Fit a copper washer to the Pressure Gauge U-tube Banjo Bolt (BF19) before passing through the U-tube Banjo (BF16). Fit a second copper washer over the protruding 1/4-inch x 40ME banjo bolt thread before installing the assembly into the remaining upper boiler barrel bush. Finally fit the Pressure Gauge located so that it faces to the front before tightening the nut.

Installing water level gauge fittings

The original design of the Steam Plant had no preference as to which pair of vertically adjacent bushes the gauge glass occupied – the idea being to make for easier installation of the gauge glass.

Rest the edge of a steel rule across the faces of each of the two pairs of vertically adjacent bushes installed in the boiler barrel. Select the pair closest to having the two bush end faces level or no more than 0.25mm (maximum) out of alignment with each other. Try each of the two pairs and choose the closest. If neither pair can satisfy this requirement you will have to choose the nearest and achieve the tolerance by means of adjusting the thickness of the washers installed between the upper and lower bushes and gauge glass bodies. The mounting stubs on the gauge glass bodies are of sufficient length to allow this. If the gauge glass bodies are any more out of line than this, there is a risk of the gauge glass cracking in use because of the stress imposed on it by the misalignment of the glands.

Having understood the tolerance required, we next have to adjust the thickness of a copper packing washer

to allow the body to become tight in the correct vertical position. The final location can be checked by means of two lengths of 5mm diameter metal rod, one cut to 58mm and the second 89mm long with the ends cleaned up, (these lengths may have to be adjusted depending on the supplier of the gauge glass fittings).

1) Fit the two gauge-glass bodies with the gland nuts fitted finger-tight, as this will have the effect of reducing the free movement of the rods.

2) Fit plain annealed copper washers to each body before screwing in to the boiler shell bush. Do not fully tighten the gauge-glass bodies into the boiler-barrel bushes at this stage.

3) Adjust the thickness of each washer in turn until each fitting begins to tighten by about 60 degrees before arriving at its required position.

4) Fit the 58mm length rod into the lower body recess. Tighten the lower gauge-glass body until the end of the rod just begins to line up with the top gland nut bore (**Photo B120**).

5) Tighten the top body until the 58mm rod can be just removed out through it.

6) Slide the 89mm rod in through the top body and tighten the top body until the rod just lines up with the bore of the bottom body gland nut (**Photo B121**).

7) Repeat the checking process, until the 58mm and 89mm rods line up with the opposite gland nut bore – taking the mid-position of the free play of the rods in the body recess/gland nut to arrive at a position with respect to the opposite gland nut bore each exactly in turn. Adjust the body positions as necessary to achieve this.

Please accept the apparent contradiction of the terms 'mid-position of the free play' and (line up) 'exactly' – it will make sense when you actually carry out the task!

Fitting glass tube to Water level Gauge

Safety Check: When carrying out any work with glass, as a minimum always wear good quality eye protection.

Remove both Gland Nuts from the Water Gauge and install the 89mm setting rod so that it sits on the ledge formed in the bottom fitting. With a fine indelible marker, mark a ring around the setting rod where it passes through the threads of the upper gland. Withdraw the setting rod and measure the distance between the end and the marked ring. To this add 6mm, which is the full length of the gauge glass required.

I would not recommend for the beginner to cut and shorten glass tube that is more than 50mm shorter than the actual length required until some experience has been gained.



PHOTO B119:

Holding nut for the pressure gauge fitting clear until silver soldering is completed.

PHOTO B120:

Setting the lower gauge-glass fitting...

Cutting glass tube is done by putting a 'nick' in the surface of the glass all the way around, at the required measurement and 'snapping' the tube at that point.

Traditionally the nick was made by filing into the surface of the tube with a small fine triangular file, going all the way round. I have found that the very thin cut-off discs available for a Dremel-type hand-held portable Multi Tool make the task of nicking the surface of the glass a very easy operation, with a much higher rate of success. They also prevent the corners of my triangular files being wrecked!

Mark all around the tube at the length required with a fine indelible marker. The easiest way is to have someone hold the Dremel firmly against a firm surface whilst you rotate the marked point on the glass



tube lightly against the rotating disc.

If such a tool is not available, support the glass tube on a wooden surface and make a visible nick on the marked ring all the way round the tube, using the corner of a fine triangular needle file.

Having produced a small visible ring completely around the surface of the tube, place your thumbs either side of the ground/filed ring, and hold the tube on each side lightly with three fore fingers of each hand, as though you were planning to bend the tube on each side of the mark to form a right angle. And simply do that! There will be a sound like a soft click and you will have two shorter pieces of glass tube, one length between the fingers of each hand – hopefully if the mark was in the right place one will be the length you wanted. Remove any sharp edges from the ends of the tube by rubbing/rotating against a fine/medium abrasive stone, or best of all if you have one, a small diamond flat file or mini stone.

After cutting the glass tube to

length and removing all sharp edges, remove the top plug from the top Water Level fitting.

- 1) Fit the O-ring supplied into the machined recess at the back of the thread in each Gland Nut.
- 2) Feed the glass tube down through the top fitting, slipping it through the top gland nut (thread up) followed by the bottom gland nut (thread down). A miniscule smear of washing up liquid on the O-rings will make things easier.
- 3) Carefully feed the glass tube into the recess of the bottom water-level fitting. Push down the lower gland nut onto the thread and make finger-tight.
- 4) Slide the top gland nut up to the top thread and make finger-tight.
- 5) Install the top plug with a copper washer to seal the top fitting. Use a spanner on the Gauge Glass top body to prevent straining the fitting when tightening the plug. **EIM**

NEXT MONTH...

Getting close to completion – Martin tunes the burner flame.

PHOTO B121:

...and the upper gauge-glass fitting. The metal rod provides a visual gauge.



■ Parts 1 to 14 of this series appeared in the October 2018 to November 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.

BENCH TALK

Clocking square shapes in a 4-jaw

Another workshop conundrum usefully solved by Edward.

BY EDWARD J PARROTT

Last time I wrote about how to clock in irregular shapes in the 4-jaw chuck, this time I've got a little trick for you to clock square bars in true. In my day job as a Turner it's not often I have to clock a square piece of material, we usually start with a round bar and do all the turning in the 3-jaw, either manual or CNC, and then mill on any squares. Once in a while it comes up – model engineers will typically find it more when working on parts such as axleboxes.

Clocking in squares can be a pain to do, as the corners don't allow a clock to work without moving it as a round bar would. The method normally employed is to set the clock up on the lathe saddle, and then set the clock on one face to read zero, wind the saddle away, rotate the job, wind the saddle back in, move the job, wind the saddle away, and so on.

I have seen people attempting to clock bars in on the corners, however, this can't produce accurate readings unless the bar has been machined square. Corners on a drawn or rolled bar cannot be guaranteed to be equally distant from the centre of the piece, and also, you're clocking at a point which is 45 degrees to the action of the jaw, making it much more

difficult to correctly adjust.

There is a simple trick to finding the centre of the piece, and it only involves your finger clock, some plastic or brass shim, and electrician's insulation tape or rubber bands!

As you can see in the picture, I've used four pieces of shim around the four sides of the square bar, and secured them with the insulation tape. You can now set your 10 thou finger clock to just kiss the inside of the square box as it rotates. Find the high spots and adjust it normally, easy! For the sake of the photo I have set my clock to work in the vertical plane but you can just as easily set it horizontal.

Over the years I've come across a lot of people who shy away from the

4-jaw, hopefully my tips will persuade a few that it's really not that scary! Now you could say, why not just use a 4-jaw self-centring chuck? Well you could, but first you'd have to own one, and if you're on a limited budget buying an independent chuck would be a much better use of your money as it is more flexible.

I think a 4-jaw self-centring chuck can only ever be successfully used on a workpiece that you can guarantee is perfectly square and dimensionally identical, otherwise, how do you get an equal clamping force on all four jaws? A lack of equal clamping force causes vibration, leading to chatter and workpieces walking themselves out of the chuck. **EIM**

RIGHT: Ed's clocking tip, described in the text and another indication that 4-jaw chucks should not be shied away from....



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Dougal – a 5-inch Barclay

Following a milestone first steaming of his entry-level project, Andrew fits the lubricator.

BY ANDREW STRONGITHARM – Part Twenty of a series

I finished the last article with the excitement of lighting the first fire and after a few trial runs up and down a short section of my club track, as expected a snagging list was drawn up to keep me busy for a few weeks. For the purpose of testing, I borrowed Andrew Brock's Railmotor tender to provide a supply of coal and water. That aside however, I was really pleased with how Dougal performed and that it successfully past its first steam test (Photo 1).

The next priority was the lubricator and I will admit that I bought a ready-made one off the shelf, which had a 1¼-inch square tank. I did however go the extra mile and fabricated the prototypical stand upon which the lubricator tank is mounted. This consisted of four pieces of ¾-inch x 1/16-inch equal section brass angle that were mounted in each corner of a base plate. I began by cutting the angle to ¾-inch in length together with a 1¼-inch square of 3/32-inch thick brass plate which I would use as the base plate. Using an off-cut of 3/32-inch brass plate, I then cut four pieces that were 5/16-inch square. These were silver soldered on the inside of each of the pieces of angle, flush with one end. For this operation, I used high-temperature C4 solder as there would be a further nearby soldering operation later on which could melt this one.

Next, I drilled four 1.8mm holes, 5/32-inch in from each corner of the brass base plate and threaded them 8BA. That was the easy bit as I now had to drill four corresponding clearance size holes (2.2mm) in the

¾-inch thick running plates. This was accomplished by carefully measuring the spacing between the holes in the base plate using a pair of dial calipers. I securely held one running plate at a time in the vice of the Bridgeport milling machine, before moving the bed of the machine over to where I should drill each hole. I initially drilled each one undersize so I could double check the position prior to opening them out to the correct size before it was too late to make any adjustment.

I machined 1/16-inch wide x 1/32-inch deep grooves in the base plate for the angle to sit in whilst being soldered. This was a fiddly job but after I had machined one corner, I made a note of the settings that I had used and turned the plate around by 90 degrees before repeating the process for the remaining three corners.

I could now silver solder all four pieces of angle on to the base plate and even with the grooves to hold them in position this was still a tricky task. Afterwards, I used an engineer's square to check the alignment of the angle against the base plate and some manual 'tweaking' was required to ensure that all four pieces of angle were perfectly straight!

The next job was to mount the lubricator on the stand and this would involve drilling through the base of the (currently oil-tight) tank. The tank should sit flat on top of the four pieces of angle with the non-return clack hanging down in the middle of these supports. I began by marking four holes in each corner on the base of the tank, each 5/32-inch in from the edge



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

and I drilled these 2.2mm. Then, after removing any residual swarf from inside the tank, I placed it down on the stand and used a centre punch to mark the position of the first hole on to the top of the supporting angle beneath.

Next, I took the lubricator tank off the stand which enabled me to drill out the punch mark to 1.8mm and then thread 8BA. Once the first hole was complete and the tank held down to the stand with a brass cheese-head screw, I repeated the above process until the tank was secured in all four corners.

During the final assembly, I applied some Loctite 574 flange sealant to each screw prior to insertion as well as between the top of the stand and the underside of the tank (Photo 2).

Belt and braces

For added peace of mind, I made and fitted a second in-line non-return valve as I didn't want to rely on the one that was supplied with the lubricator. This horizontal fitting was fabricated in two halves with the main body containing a spring and a 5/32-inch stainless steel ball, and a smaller cap which screws in to this to form the flat seating for the ball.

I began by facing off a 1-inch length of 5/16-inch diameter PB102 bronze and turned down a 1/4-inch length to 1/4-inch diameter before externally threading this section 1/4-inch x 40 tpi. I then drilled a 2.8mm hole all the way through before machining a 60-degree countersink in the end ready to accept a pipe olive.

Next, I turned the piece around in the chuck and opened out the inside diameter of the hole to 7/32-inch using a long series end mill to a depth of 5/8-inch. I could now internally thread this 1/4-inch x 40 tpi to a depth of 1/4-inch ready for the cap to screw in to.

The cap itself started life as a 5/8-inch length of 5/16-inch diameter bronze that I turned back and cut a

PHOTO 1:

That moment you never forget – the first steaming of the first locomotive you've built. On such an occasion even the weather doesn't matter...

All photos in this feature by the author



$\frac{1}{4}$ -inch length of $\frac{1}{4}$ -inch x 40 tpi threads on both ends. This left $\frac{1}{8}$ -inch of land in the middle and after drilling a 2.8mm hole throughout, I machined another 60-degree countersink in one end, which left the other end flat for the ball to seal against. Finally, I bought a light $\frac{3}{16}$ -inch outside diameter stainless steel spring which I cut on an off-hand grinder and flattened back to an approximate length of $\frac{3}{8}$ -inch. When cutting the spring to length, it is important to ensure it is long enough to compress the ball against the flat seat to prevent any oil from returning up the pipe.

A pair of $\frac{5}{32}$ -inch diameter copper pipes and associated $\frac{1}{4}$ -inch x 40 tpi fittings were added next and these ran from the non-return valve on the bottom of the lubricator tank to the second non-return valve and then to a 90-degree elbow fitting which I screwed in to the cover of the steam chest. These pipes were carefully bent into position and run behind the front right-hand side tank.

Vital actions

Once the oil line is complete, it is important to thoroughly prime the pipes before running a locomotive for the first time by manually pumping the lubricator to ensure the pipes are filled with oil and there is no air left in the line. Failure to do so could result in what is known as the lubricator 'blowing back', when the oil supply is disrupted and allows steam to get past the non-return valves, enter the tank and mix with the oil. Should this occur when running a locomotive you should immediately cease operation, clean the tank (and possibly the non-return valves) and re-prime the oil line to the steam chest/pipes.

Repeated problems could indicate defective non-return valves or a leak past the pump. The latter should also be checked before fitting to the locomotive by means of a hydraulic test. A good lubricator should be able to pump and maintain a pressure equivalent to the working pressure in the boiler, and exceed this by several factors if made well.

The drive mechanism for the lubricator was designed to replicate as closely as possible the linkage on the full size Dougal. It is driven off the right-hand crosshead and I made a special plate out of steel to drive the pull rod which runs below the running plate.

The 2mm thick plate was $\frac{1}{2}$ -inch square and I drilled a pair of 2.5mm holes, spaced $\frac{1}{4}$ -inch apart and $\frac{3}{32}$ -inch in from the top edge, to bolt the plate to the centre of the crosshead. I had to re-make the middle two fixing bolts which hold the top of the

crosshead in place as these were now too short once this extra plate had been mounted on the side.

I then drilled a 2.5mm hole through the plate, $\frac{1}{8}$ -inch in from the bottom edge and I threaded this 5BA before applying a deep countersink in the back of it. This was to create a void ready to fill with silver solder once I had made and fitted the drive pin. This was turned from a $\frac{3}{8}$ -inch length of $\frac{1}{8}$ -inch round steel and I threaded both ends 5BA by a length of 80 thou' and $\frac{1}{16}$ -inch respectively.

The longer end was then screwed in to the mounting plate and after ensuring that it was straight and square, I silver soldered this in. After cleaning off any excess flux and solder from the back face, I bolted the plate on to the crosshead and began working on the first of the lubricator linkage pull rods.

As appears to be the case with many things on Dougal, these were not that straightforward, because the pull rod beneath the running plate had to have a double bend in it to ensure that it met the pivot bar, which itself is slightly bent to make sure that it did not hit the injector!

The pull rod was made from a length of $\frac{1}{8}$ -inch stainless steel round and it began life roughly $2\frac{1}{4}$ -inch long (although without unbending it I can't be 100 per cent sure) and once bent the finished length was 2 inches. First, I threaded a $\frac{5}{16}$ -inch length on both ends of the rod 5BA, which was deliberately longer than I needed but gave me extra adjustment when it came to setting up the travel on the linkage. The double bends gave the rod an offset of $\frac{1}{4}$ -inch and I achieved this by heating the rod until it was glowing red hot and holding it between a pair of clamps at each end, before carefully bending it round a suitable former.

Use the forks

The next job was to machine four virtually identical fork ends for the lubricator linkage. These began life as $\frac{1}{4}$ -inch square steel and I cut them to $\frac{5}{8}$ -inch lengths before putting each one in the self-centring four-jaw chuck to face off the ends. $\frac{1}{8}$ -inch of the end of the material was then turned round to a diameter of $\frac{3}{16}$ -inch and I drilled a 2.5mm hole through this end to a depth of $\frac{3}{16}$ -inch before threading it 5BA.

Now I could take them out of the chuck and set up three of them in the vertical slide on the lathe to machine the slot using a $\frac{1}{8}$ -inch diameter slot drill. The fourth fork end was destined for the bracket on the crosshead and as such it only needed the cross hole drilling and no slot. The slots were machined to a depth of

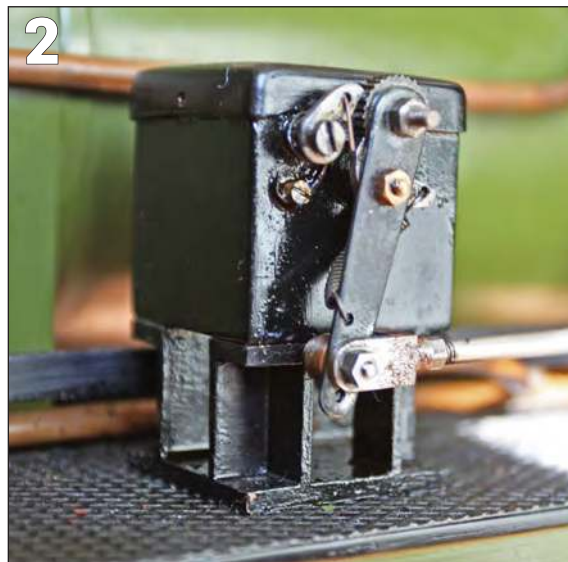


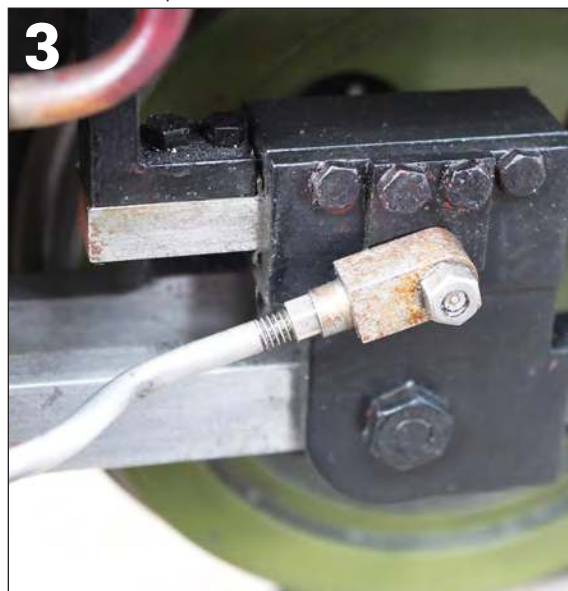
PHOTO 2: The mechanical lubricator mounted in its position on the running plate.

PHOTO 3: Connection from the lubricator to the crosshead.

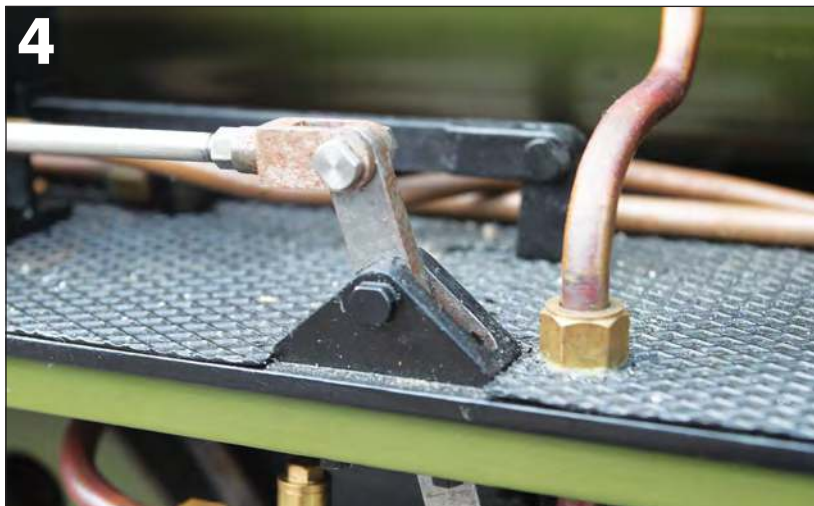
$\frac{3}{8}$ -inch and then I re-set the fork ends so I could drill the cross holes (initially undersize to check the positioning before drilling/reaming them out) to a finished diameter of $\frac{1}{8}$ -inch. The final job was to round off the fork ends and a $\frac{1}{4}$ -inch diameter hardened filing button was made to aid shaping them using a file and emery paper (Photo 3).

Four 5BA locking nuts were then machined from $\frac{5}{32}$ -inch stainless steel hexagon and a pair of shouldered fitted pins were turned from $\frac{3}{16}$ -inch round stainless steel. They had 255 thou' of $\frac{1}{8}$ -inch diameter plain section and in addition to this, $\frac{1}{8}$ -inch of 8BA threads on the end. The pins were deliberately made in this way so the nuts locked up against the shoulder and did not clamp the fork which could potentially restrict the free movement of the linkage. Two 8BA nuts were made from $\frac{5}{32}$ -inch stainless hexagon to finish off the pins.

The pivot bar was made from a $3\frac{15}{16}$ -inch length of $\frac{1}{8}$ -inch x $\frac{1}{4}$ -inch steel and I drilled two 3.2mm ($\frac{1}{8}$ -inch) holes $\frac{1}{8}$ -inch in from either end



4



through the bar. I then drilled a third $\frac{1}{8}$ -inch diameter hole which was for the pivot itself and this was $\frac{11}{16}$ -inch in from one end of the material.

The pivot block is mounted on top of the running plate on the model whereas it is mounted underneath on the full-size Dougal. The pivot block was machined from a length of $\frac{3}{4}$ -inch square steel bar and I cut a $\frac{3}{8}$ -inch thick piece off the end which I then went on to cut diagonally in half to form my triangular pivot block.

Once the cut edges had been faced off and machined flat, I began to insert the $\frac{13}{16}$ -inch long slot, which the pivot bar would run through, with a $\frac{1}{8}$ -inch diameter slot drill. Due to the depth of the slot, I only took 5 thou cuts with each pass of the slot drill and after noting down the dimensions that I was working to on the lathe dial, I took my time to ensure that I didn't over travel and cut in to the side.

Once the slot had broken through the bottom of the block, I cleaned up the edges with a needle file before setting up the pivot block to drill the $\frac{1}{8}$ -inch diameter pivot hole. This was positioned $\frac{1}{8}$ -inch in from both of the

shorter sides at the top of the block.

The next job was to round off the top using a trusty hardened filing button and trial assemble the pivot bar through the slot to check that it had enough clearance to pivot smoothly.

Not so easy

The trickiest task was to mount the pivot block on the right-hand running plate as the land available either side of the slot was only $\frac{1}{8}$ -inch. I began by establishing the largest bolts I could use and after deciding upon 8BA, I worked out where each of the four holes would be positioned on the base of the pivot block. I marked these measurements on to the running plate before carefully mounting the entire plate on the Bridgeport milling machine to drill out the holes to the clearance size of 2.2mm.

Then, with a narrow engineer's clamp I held the pivot block over these holes and after checking the positioning of it, I spotted through the first hole using the same 2.2mm drill to leave a mark on the base. After drilling this out 1.8mm and threading 8BA, I screwed the block on to the

"The last thing I wanted to do now was make a mistake and potentially write-off the whole running plate..."

running plate before repeating the process above for the remaining three holes (Photo 4). Whilst the running plate was off the locomotive, I machined the slot through it, although I cannot stress how careful I was during this operation because the last thing I wanted to do now was make a mistake and potentially write-off the whole running plate!

As I mentioned earlier, I had to bend the pivot bar out slightly below the running plate to avoid hitting the injector. It was only once I could assemble these components that I could establish exactly where this bend had to be.

The final rod to make (between the top of the pivot bar and the drive arm on the lubricator tank) was also the simplest because this was a straight $2\frac{5}{8}$ -inch length of $\frac{1}{8}$ -inch stainless steel and I cut a $\frac{1}{4}$ -inch length of 5BA threads on both ends.

Putting it all together

With that rod made, I could now assemble all the linkage and begin to set the travel to produce the desired throw. I intended to set the ratchet wheel on the lubricator to move one tooth for each revolution of the wheels, anything less than this and the ratchet will not rotate.

I started by winding one 5BA locking nut on to each end of both pull rods before screwing a fork end on afterwards. The solid fork end must be screwed on to the crosshead drive rod and they can all be adjusted by screwing the fork ends on or off until the total travel is about right. This can only be properly tested by pushing the locomotive up and down to ensure the ratchet wheel is 'clicking' over. Once I was happy with the linkage, I screwed the locking nuts up to meet the fork ends and tightened them up. (Photo 5). **EIM**

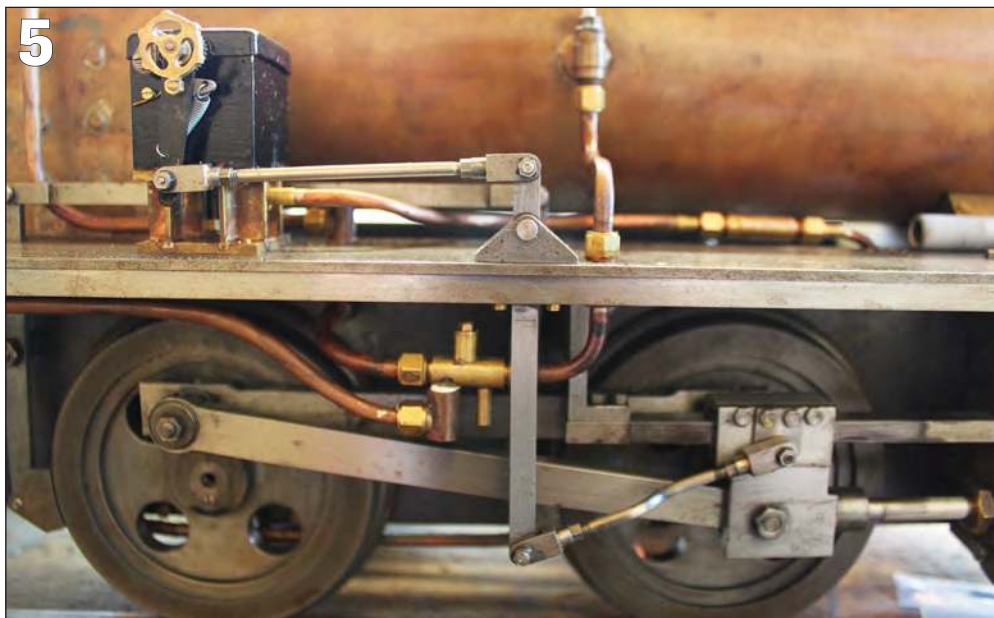
PHOTO 4:

The pivot block mounted on the running plate – fixing this was tricky due to a lack of space for the bolts.

PHOTO 5:

The completed lubricator, showing the rods taking propulsion from the loco's motion.

5



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Drawings, castings and material for this project are available from A J Reeves.

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Next Month...

"I used traditional files, a belt linisher and copious amounts of emery paper!" Andrew constructs the water tanks for his locomotive.



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Stand: 65

PEAK TOOLS

Willow Brook House, Shatton Bamford,
Hope Valley, Derbyshire, S33 0BG
Stand: 93-95

PERMA-GRIT TOOLS /ALUTIGHT

The Old Forge, Osbournby, Sleaford,
Lincolnshire, NG34 0DN
Tel: 01529 455034
Email: sales@permagrit.com
Web: www.permagrit.com
Stand: 92

POLLY MODEL ENGINEERING

Atlas Mills, Birchwood Avenue, Long
Eaton, Nottinghamshire, NG10 3ND
Tel: 0115 9736700
Email: sales@pollymodelengineering.co.uk
Web: www.pollymodelengineering.co.uk
Stand: 46-48

POP POP STEAM BOATS

Blennerhasset Watermill, Blennerhasset
Nr Aspatria, Carlisle, Cumbria, CA7 3QQ
Tel: 01697 323523
Stand: E8

PORTSONACHAN HOTEL

Portsonchan Hotel and Lodges, South
Loch Awe Side, Nr Dalmally, PA33 1BJ
Tel: 01866 833224
Email: portsonchan8@aol.com
Web: www.portsonchanhotel.co.uk
Stand: 16

POWER CAPACITORS

30 Redfern Road, Tyseley
Birmingham, B11 2BH
Tel: 0121 708 4522
Email: transwave@powercapacitors.co.uk
Web: www.powercapacitors.co.uk
Stand: E1

RDG TOOLS

7/8 White Lee, Caldene Business Park,
Mytholmroyd, West Yorkshire, HX7 5AD
Tel: 01422 885069
Email: rdgtools@aol.com
Web: www.rdgtools.co.uk
Stand: 33-40+ 45

SHOW WAVE/ MIRACLE SHAMMY

PO BOX 123, Ware, Herts, SG12 9WG
Tel: 07900 007061
Email: dave@showwave.co.uk
Web: www.showwave.co.uk
Stand: 88

STUART MODELS (UK)

Grove Works, West Road
Bridport, Dorset, DT6 5JT
Tel: 01308 456859
Email: sales@stuartmodels.com
Web: www.stuartmodels.com
Stand: 58+59

TEE PUBLISHING

The Fosse, Fosse Way,
Leamington Spa, CV31 1XN
Tel: 01926 614101
Email: info@teepublishing.co.uk
Web: www.teepublishing.co.uk
Stand: 1+2

THE CRAFTLIGHT COMPANY

32 Gunton Church Lane, Lowestoft,
Suffolk, NR32 4LF
Tel: 01502 587598
Email: info@craftlights.co.uk
Web: www.craftlights.co.uk
Stand: E4

TOOLSTOP

16 Great Holland Square
Bracknell, Berkshire, RG12 8UX
Tel: 01344 421718
Email: toolstopsales@aol.com
Stand: 122-125

TRACY TOOLS

Unit 1, Parkfield Ind. Estate
Barton Hill Way, Torquay, TQ2 8JG
Tel: 01803 328603
Email: info@tracytools.com
Web: www.tracytools.com
Stand: 96-98

TURBOCAD

Signal View, 61 Station Road,
Liss, GU33 7AA
Tel: 01962 835081
Email: paul@paulthecad.com
Web: www.paulthecad.co.uk
Stand: 85

TURBOTRADEUK

Tel: 07926 256551
Email: turbotradeuk@gmail.com
Web: www.turbotradeuk.co.uk
Stand: 60

WALKER MIDGLEY INSURANCE BROKERS

The Balance, Pinfold Street,
Sheffield, S1 2GU
Tel: 0114 2502770
Email: enquiries@walkermidgley.co.uk
Web: www.walkermidgley.co.uk
Stand: 91

WHOTZHOT

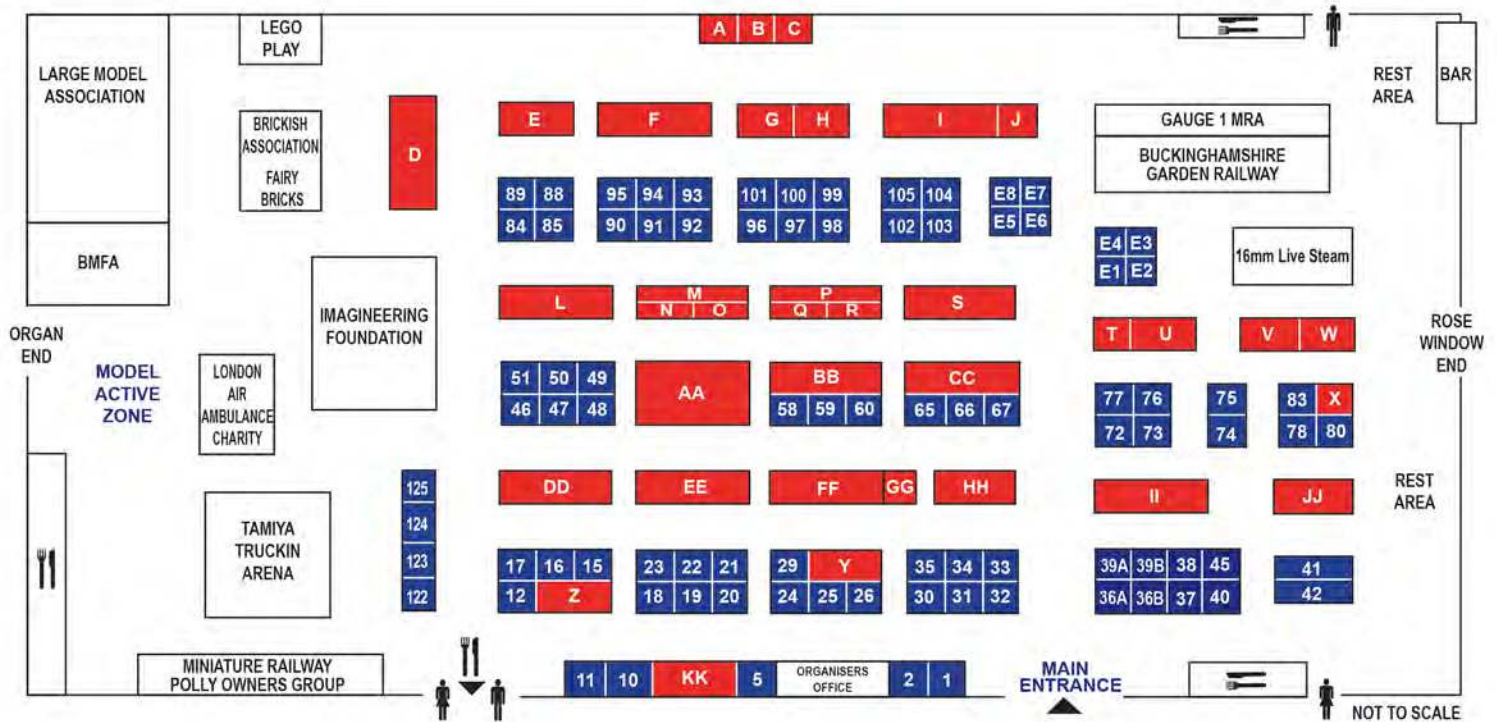
8 Southway, Southwell Business Park,
Portland, Dorset, DT5 2NL
Tel: 01305 823888
Email: whotzhot@btconnect.com
Web: www.whotzhot.info/superwrench
Stand: 84

WOODLAND TRUST

Tel: 0330 333 3300
Web: www.woodlandtrust.org.uk
Stand: E6

All information correct @ 25.11.19
but subject to change due to
circumstances beyond our control.

We expected more exhibitors to be
confirmed over the coming weeks.
Please check our website for the latest
information.



SOCIETY STANDS, CLUBS & DEMONSTRATIONS

7 1/4" GAUGE SOCIETY

Stand: M

www.sevenandaquarter.org

10 1/4" GAUGE SOCIETY

Stand: L

www.tenquarter.org

ASSOCIATION OF LONDON MODELLERS

Stand: C

www.londonmodellers.co.uk

B17 STEAM LOCOMOTIVE TRUST

Stand: R

www.b17steamloco.com

BLACKHEATH MODEL POWER BOAT CLUB

Stand: G

BUCKINGHAMSHIRE GARDEN RAILWAY SOCIETY "WHITELEAF LIGHT RAILWAY"
Buckinghamshire Garden Railway
www.bgrs.org.uk

CHELMSFORD SOCIETY OF MODEL ENGINEERS

Stand: D

www.chelmsfordsocietyofmodelengineers.org.uk

EAST SURREY 16MM GROUP

RIDGEMONT RAILWAY
16mm Live Steam On Floor Plan
www.eastsurrey16mmgroup.webs.com

EASTLEIGH YOUNG ENGINEERS

Stand: GG

www.eyecub.co.uk

GAUGE 1 MODEL RAILWAY ASSOCIATION

GAUGE 1 MRA

www.g1mra.com

GAUGE 3 SOCIETY

Stand: T

www.gauge3.org.uk

HAPPY HOBBY MODELLERS

Stand: E

HARLINGTON LOCOMOTIVE SOCIETY

Stand: HH

www.harlingtonlocomotivesociety.org.uk

HARROW & WEMBLEY SOCIETY OF MODEL ENGINEERS

Stand: P

www.hwsme.org

ICKENHAM & DISTRICT SOCIETY OF MODEL ENGINEERS

Stand: W

www.idsme.co.uk

IPMS BARNET MODEL CLUB

Stand: A

www.ipmsbarnet.co.uk

IPMS HORNCHURCH

Stand: B

www.sticky-fingers.org.uk

MAIDSTONE MODEL ENGINEERING SOCIETY

Stand: II

www.maidstonemes.co.uk

MODEL HYDROPLANE CLUB

Stand: S

MOORHEN MODEL BOAT CLUB

Stand: I

www.moorhenmodelboatclub.co.uk

NORTHERN ASSOCIATION OF MODEL ENGINEERS

Stand: Q

www.nameng.org.uk

NORTHOLT MODEL RAILWAY CLUB

Stand: EE

www.northolt-mrc.org.uk

OO LIVE STEAM CLUB

Stand: AA

www.oolivesteam.com

REMAP

Stand: N

www.remap.org.uk

ROMFORD MEC

Stand: V

www.romfordmec.com

ROYAL SPITHEAD REVIEW & KEEL

HISTORIC HARBOUR

Stand: Y

SOCIETY OF MODEL & EXPERIMENTAL ENGINEERS (SMEE)

Stand: BB

www.sm-ee.co.uk

SOUTHERN FEDERATION OF MODEL ENGINEERING SOCIETIES

Stand: O

www.sfmes.co.uk

ST ALBANS & DISTRICT MODEL ENGINEERING SOCIETY

Stand: FF

www.stalbansmes.com

SURFACE WARSHIP ASSOCIATION

Stand: F

www.surface-warships.org.uk

SUSSEX MINIATURE LOCOMOTIVE SOCIETY

Stand: JJ

THE HOLDEN F5 STEAM LOCOMOTIVE TRUST

Stand: X

www.holdenf5.co.uk

THE MODEL RAILWAY CLUB

Stand: J

www.themodelrailwayclub.org

THE SOCIETY OF ORNAMENTAL TURNERS

Stand: U

www.the-sot.com

VICTORIA MODEL STEAMBOAT CLUB

Stand: H

www.wgcsme.wordpress.com

WELWYN GARDEN CITY SOCIETY OF MODEL ENGINEERS

Stand: DD

www.wgcsme.wordpress.com

WEST LONDON MECCANO SOCIETY

Stand: CC

www.wlms.org.uk

MODEL ACTIVE ZONE

BRICKISH ASSOCIATION

www.brickish.org

BRITISH MODEL FLYING ASSOCIATION

www.bmfa.org

FAIRY BRICKS

www.fairybricks.org

IMAGINEERING FOUNDATION

www.imagineering.org.uk

LARGE MODEL ASSOCIATION

www.largemodelassociation.com

LONDON'S AIR AMBULANCE CHARITY

www.londonsairambulance.org.uk

POLLY OWNERS GROUP

www.pollyownersgroup.org.uk

TAMIYA TRUCKIN

www.tamiyatruckin.org.uk

SPECIAL DISPLAYS

BOND 25

Stand: Z

Visit our James Bond display on stand Z, a thrilling arrangement of models based on the James Bond films, made by Chris Scott.

EMERGENCY SERVICES

London's Air Ambulance Charity

This year's show pays a special tribute to the emergency services and armed forces. Over 500 emergency services and armed forces models will be displayed throughout the hall. Visit London's Air Ambulance Charity with their Helivan and demonstrations of the HELIMED app! All Blue Light, NHS or Armed Forces Discount card holders are entitled to £10 tickets on the door.

LITTLE INVENTORS

Stand: KK

For the first time, we shall have a display from Little Inventors bringing the imagination of kids to life! As always this is an event to both indulge the passion of seasoned model engineers and inspire the next generation.



@LMEE20



London Model Engineering Exhibition

Travel Information

Alexandra Palace is located in North London & is easily accessible by car & public transport.

BY CAR

There is free parking at Alexandra Palace offered on a first-come-first-served basis. However, these car parks do get full very quickly. We strongly advise that where possible you visit the show by public transport.

Alexandra Palace is situated:

1 mile from the North Circular Road (A406)
5 miles from the M1 (Junction 2)
8 miles from the M25 (Junction 25)
Major roads are signposted to Alexandra Palace.
Enter postcode N22 7AY into your SATNAV.

BY BUS

The W3 bus runs from Wood Green & Finsbury Park Station & will take you to the Alexandra Palace Palm Court entrance. The W3 runs every 5-8 minutes on Friday, 6-10 minutes on Saturday & 9-12 minutes on Sunday.
If you are travelling from North London the 184 towards Turnpike Lane Station stops at Alexandra Palace Station. The 184 runs every 7-11 minutes Monday to Friday, 6-10 minutes on Saturday & 10-12 minutes on Sundays.

BY UNDERGROUND

To plan your journey please visit www.tfl.gov.uk

Finsbury Park - on the Victoria Line & Piccadilly Line -

When you arrive at Finsbury Park take the W3 bus towards Northumberland Park. Get off at Alexandra Palace Palm Court. This takes you directly to the main entrance of the show. The W3 runs every 5-8 minutes Monday to Friday, 6-10 minutes on Saturday & 9-12 minutes on Sunday.

Wood Green - on the Piccadilly Line - is the nearest underground station. When you arrive at Wood Green take the W3 bus towards Finsbury Park Station. Alternatively take the free shuttle bus service to the show. The W3 bus runs every 5-8 minutes Monday to Friday, 6-10 minutes on Saturday & 9-12 minutes every Sunday.

BY RAIL

To plan your journey please visit www.nationalrail.co.uk

Alexandra Palace has its own British Rail Station (Alexandra Palace Station). A regular train service runs direct from Moorgate (weekdays only) or from Kings Cross, changing at Finsbury Park. Once you get off at Alexandra Palace you can take the W3 bus or the free shuttle bus service to the show. Alternatively, you can walk (15-20 minutes) directly to the venue.

BY SHUTTLE BUS

Free Shuttle Bus from Wood Green Station & Alexandra Palace Station

This bus is on a constant loop & takes you directly to the show.

10am-5pm Fri & Sat
10am-4.30pm Sun

Last entry Friday & Saturday
4.00pm Sunday 3.00pm.
The Model Active Zone will close at 3.30pm on Sunday.

Venue:

Alexandra Palace Way,
Wood Green, London
N22 7AY

Essential Visitor Information

All exhibitors and attractions are subject to change but are correct as at date of printing for this magazine in late November 2019.

Cash Machine

This is located in the Palm Court area by the main entrance to Alexandra Palace.

Cloakroom

This is situated in the Palm Court area.

Courtesy Buses

This service is in operation between the paddock car park and the main entrance as well as the two nearby railway stations.

First Aid

If you require first aid please see any member of our security staff who will contact the duty medic.

Lost Property

Please go to the TEE Publishing stand to report any lost or found property or contact any member of our security staff.

Organisers Office

Located with the TEE Publishing bookstand - stand numbers 1 & 2.

Parking

Parking is free to all visitors and disabled parking is available on a first come first served basis.

Location

Alexandra Palace, Alexandra Palace Way,
Wood Green, London N22 7AY.

Places to Eat and Drink

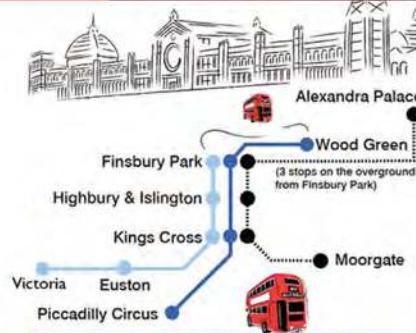
Numerous restaurants and bars are available. The main bar is within the Palm Court area and the main seated restaurant is the Palace Suite which is located on the lower ground floor. There are also numerous outlets within the Great Hall to cater for all your needs.

Smoking

Alexandra Palace is strictly a no smoking venue in compliance with regulations. Please ensure you are outside of the building if you wish to smoke.

Toilets

Ladies and Gents facilities are located in the following areas: Palm Court, Great Hall and Palace Suite Restaurant area.



There is an increased provision for disabled spaces for this event however this is in high demand so please arrive early to secure a space.
A courtesy bus operates from the paddocks car park at Alexandra Palace from 8.15am each day.



Please see our website for more detailed travel information or visit www.alexandrapalace.com

TICKET	ONLINE TICKETS*	FULL PRICE TICKETS**
Adult	£11.50	£12.50
Senior Citizen/Student	£11.00	£12.00
Child (5-14 yrs)	£4.00	£4.50

*ONLINE TICKETS www.londonmodelengineering.co.uk

Discounted tickets are available via our website until midnight Tuesday 14th January 2020.

There are two delivery options:

- E-ticket (Print-at-home) (Transaction Fee £0.00) Your tickets will be attached to your confirmation email. Please ensure you bring printed copies of your tickets to the event, as you will not gain access to the venue without them.
- Standard Delivery (Transaction Fee £1.50) Your tickets will be delivered to the address you specify. These will be dispatched from 1 month prior to the event.

Please call SEE Tickets on 0115 896 0154 if you would like to book a ticket by phone or have any questions when booking your tickets. Meridienne Exhibitions cannot process any telephone orders for this exhibition & you must call SEE Tickets. If you have any general queries other than to order tickets please call 01926 614101.

**FULL PRICE TICKETS

These are available on the day of your visit from the cash box. Ticket office opens at 9am each morning. Alexandra Palace telephone booking line 0844 854 0062



Book your tickets at www.londonmodelengineering.co.uk

All details correct at time of going to press. Subject to change. Please check website for up to date information. Errors and omissions excepted.



Table top to Rally field

Len Witt's first large-scale model took him from watching to partaking in the rally action.

BY ALAN BARNES

With steam rollers and traction engines for a 'playground' it is hardly surprising that Len Witt from Cramlington in Northumberland developed an interest in steam and engineering at a very early age.

As Len told me "My grandfather worked for the Northumberland County Council and was in charge of one of the Council steam road rollers. He would be out all week with the roller and living van, building and repairing roads all over the county, but at weekends he would bring the roller back to his home in Morpeth and park it outside his house.

"This was obviously a magnet for me and my friends and we were able to 'play steam engines' until it was time for the engine and my grandfather to return to work. I do not have any record of the number of the Aveling & Porter roller but I do have the Invicta crest from the front of the engine which my grandfather kept and later passed on to me."

Another of the 'playground' subjects from Len's boyhood has survived into preservation. One of Len's uncles was from the Davidson family which operated a steam contracting and farming business at Thropton in Northumberland.

Connected by a crash

In 1929 a Burrell Showman's engine was involved in an accident at Waverton in Cumberland when a cellar ceiling collapsed and the heavy engine crashed through it. The engine, works number 3555 today named 'Busy Bee', was recovered, its damage repaired and subsequently bought by



ABOVE: Len Witt's fine 4-inch Burrell.

BELOW: 'Busy Bee' In a yard in 1951, played on by a young Len.

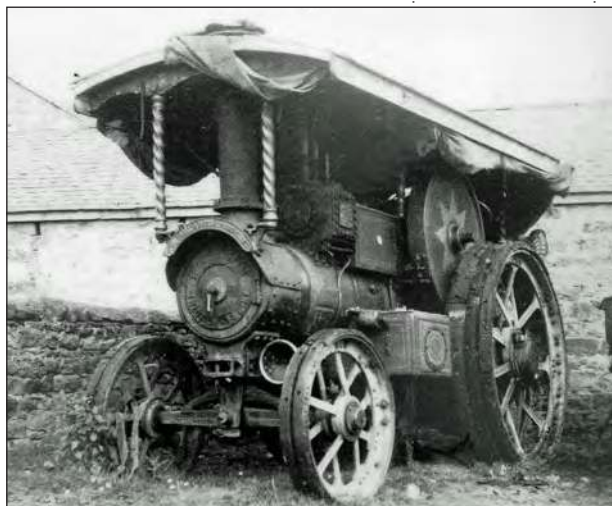
BELOW RIGHT: Busy Bee looks much better today.

the Davidson family who moved it to their premises at Thropton.

For some years it was used in their business until it was laid up in their yard where it made another ideal playground for young Len. The engine was eventually recovered by Dr John Middlemiss in 1953 and he restored it and rallied it for many years until it was subsequently sold to Patrick Edwards who owns it today.

With engines and steam in Len's blood and a growing interest in all types of machinery his family were

hardly surprised when he started work as an apprentice fitter and turner at the Vickers Armstrong factory at Elswick, working his way through the ranks to become a tool maker. He also developed an interest in model making and applied the techniques he was learning to the building of finescale models. "I had no specific interest as far as the models were concerned – I just built anything that appealed to me, steam locomotives, traction engines and motorcycles. I also built a few steam engines but





these were not live steam, they ran on compressed air”

Len left Vickers Armstrong in 1964 and took a job at the new Wilkinson Sword factory which had opened at Cramlington. “Officially I was an engineer but I became involved and ultimately responsible for making all the models and prototypes which the company used to develop and advertise its products. The ‘Powers That Be’ had become aware of my interest in model making and decided that I was the right man for the job. It was great to have a hobby as a real job although sadly there was not much call for models of steam engines.”

Len described his 10 years at Wilkinson Sword as very enjoyable and very interesting times; “It was

“I maintain that you cannot make a large part on a small machine but you can make the smallest part on a large machine...”



very satisfying to see the models which I had made appearing on the TV adverts.” Then in 1974 he moved to Rocket Medical in Washington, a firm which specialised in making disposable medical equipment for hospitals. “Here there was little opportunity to produce models of any type but the work itself was interesting and I became involved in the making of equipment which was being used in the development of IVF treatments, cutting-edge technology at the time.”

Len stayed with the company until he retired. His interest in model making had remained and he was still producing fine models during his spare time in a workshop at his home. “Most of the models I was making during the 1970s were small-scale ‘table top’ engines and locomotives and I used to have a small display at rallies such as Brunton and Carlisle.”

Growing envy

For a while he diversified into antique guns and flintlocks which he also used to show but the restrictions eventually became too onerous and he returned to model making; “Sitting behind my display table of small models I became envious of the

miniature engine owners who were able to ‘trundle’ around the rally field on their live-steam traction engines.”

In 2007 Len was talking to friend Kenny Rogers, not the singer but a miniature steam enthusiast who owned a 4-inch scale Burrell traction engine. “At the Brunton show that year I had a good chat with Kenny and was able to have a close look at his engine. As we spoke the idea of building a scale miniature of my own began to appeal, after all it would be just another model only to a slightly larger scale than I was used to. My workshop was already well equipped with a range of machinery which could handle most of the work so that would not be a problem.”

Having researched what was available on the market Len opted to build a 4-inch Burrell using parts from Steam Traction World. “I ordered a few parts so that I could start work. I had no fixed deadline but I was certainly in no rush as this would be a new model-making experience for me and I would be working on the largest machine that I had ever built. There would also be some experimentation along the way to establish the best way of dealing



with some aspects of the project and I hoped to put my own 'stamp' on the resulting scale engine."

The equipment in Len's workshop proved to be ideal for the work although he believes some of the Harrison and Elliott lathes and milling machines may be regarded as being too large by some other modellers. "I maintain that you cannot make a large part on a small machine but you can make the smallest part on a large machine."

Len ordered the boiler and firebox from Steam Traction World and while awaiting delivery he began work on the wheels, cylinder and parts of the motion. "As a toolmaker I have had years of experience working to very fine tolerances and I thought that the quality of the castings and parts from STW was first class."

"However I did decide to rework some of the parts and for the motion I used the original parts as patterns for a new set of parts which I made using stainless steel which I find gives a much better finish. I adopted this approach on several other parts which I made out of alternative materials and all this reworking resulted in a stock of original parts. I probably have enough of the original bits to build another engine!"

Too accurate?

His previous model-making experiences had always involved the use of very fine tolerances but Len found that this was not always the best approach when dealing with a live-steam model. "I did find that working to the exacting tolerances used in toolmaking was not appropriate for the Burrell. Testing the motion with compressed air I found that everything was very tight and this got worse when the engine was first tested in steam and everything was hot. Allowances had to be made when making parts which would expand when they became warm."

He adopted what he now refers to as the 'Appropriate Engineering' approach, making the parts as accurate as possible but ensuring that those components that will be affected by heat are made with sufficient tolerances, able to cope with expansion and contraction without affecting their operation.

Len completed the Burrell in 2010, the unpainted but fully assembled engine tested on compressed air and then in steam. As he recalled; "I was pleased that there were only a few minor adjustments needed and a couple of small leaks to attend to but now that the engine was a 'runner' it had to be dismantled for painting."

"All the parts were cleaned, prepped and given coats of primer and

FACING PAGE:

Detail pictures of a very well-built model.

RIGHT: An extension chimney helps keep smoke from the driver when on the rally field.

BELOW: The Burrell at Kelso Show in 2019, eight years after its debut and with Len now experienced on the regulator.

All photos in this feature by Alan Barnes



the spray-painted topcoats and for the lining I used thin lining tape and a fine brush. Once all the parts were painted and thoroughly dry the engine was re-assembled in time for its first rally at Kelso in May 2011."

While building the engine had created challenges for Len the rally field presented yet more problems to be overcome. "Until now I had been used to just sitting behind my table of models chatting to anyone who showed an interest. Now I was sitting on the back of a steam engine which refused to do what I wanted it to do."

Fortunately there was help on hand and experienced engineman Michael Charlton gave Len a few pointers. "He spent some time showing me how to set the regulator, maintain the fire and water and get the best out of my new engine."

The Burrell has been regularly

rallied in the northeast of England over the past few years and in 2016 was awarded the Raymond McMahon Trophy for the Best Road Vehicle in Steam at the Doncaster Show, well deserved recognition of Len's skill and attention to detail.

Over the years Len has taken a good number of youngsters under his 'engineering wing' teaching them the correct use of machinery and how to handle materials and build models of their own. He considers that passing on these skills to the next generation is vital. "If I can get someone hooked on scale engineering I consider that the time is very well spent and seeing someone that I have trained go on to produce first-class models of their own is very rewarding."

My thanks to Len for taking the time to tell me about the construction of his very fine Burrell. **EIM**



Building simple wagons for the Apple Valley Railway

Simon builds freight stock to run on the 7¼-inch gauge ride-on railway that he constructed in his garden, like the line created very much to a budget...

BY **SIMON MACE** – Part five of six



Every narrow gauge railway seems to have a collection of small wagons, and even miniature garden railways have loads to haul. Fortunately building simple four-wheeled wagons can be really simple (and pretty cheap too).

This article explains how I build the basic flat wagons for my Apple Valley Railway, and gives a couple of ideas for variations. Please note that while I have included a few dimensions, they are in no way

absolute. You can vary the sizes to suit your railway, and available materials. The basic concept can also be easily scaled down to 5-inch gauge.

The basis of each wagon is a frame of square timber. I use 2 x 2-inch softwood from my local DIY centre. T-brackets keep the chassis roughly square during assembly, attached using 1-inch woodscrews. These are only lightweight, but this is acceptable as they don't take any drawing or buffing loads in the finished wagon.

I usually make each chassis about 16 inches wide and 24 inches long (although some variety makes for a more interesting train).

Longitudinal strength comes from lengths of M8 studding (also known as all-thread) passed through holes drilled in both buffer beams. Nuts and large washers on the outside of the chassis pull the buffer beams tight against the main chassis rails, and take the load from the couplings. The tension on the studding can be confirmed by 'plucking' them like a guitar string – if they make the same note then they are close enough to evenly loaded!

The wheels and axles are obtainable fully machined from a number of suppliers; a few are listed at the end of the article. Wheel sets are fitted with self-aligning 'Plummer block' bearings. I like to use the type of Plummer blocks with a cast-iron body as they look more like the prototype, but the cheaper pressed-steel type would work just as well. Helpfully these bearings are easily available online (try eBay, or specialist industrial suppliers) and they come in a wide range of metric and imperial sizes; very useful if you are fitting a wheel set purchased secondhand...

ABOVE:

Variations on a freight theme; the flat wagon is joined with a box truck and weed-killing tanker to make a rustic train

PHOTO 1: The basic chassis frame parts trial assembled and square.

All photos by the author





The bearings can be attached to the chassis with either coach screws or coach bolts (bolts are more secure long-term, but need a bit more thinking about when fitting the deck planks). Deck planks can be nailed or screwed on (I use 75x20mm planks) and your choice of varnish or paint then applied.

Couplings can be bought from miniature railway suppliers, but if budgets are tight M8 clevis forks (sold for car trailer brake systems) make an effective substitute.

No suspension here

You have probably noticed that I have not mentioned suspension anywhere – well that is because none of my wagons have any! This is not as big a problem as it may appear, the wheelbase is pretty short (I stick to 12 inches maximum), and the chassis is intentionally very flexible so that the wagons can flex to accommodate poor track. I have run my stock on my own railway, other private lines, and a couple of club tracks and they have been remarkably derailment-free.

Once you have a couple of flat wagons, it is easy to work up more interesting variations. Open trucks, driving trucks, and even tank wagons can be created even with rudimentary woodworking skills. **EIM**

Wheelset suppliers

www.pnp-railways.co.uk
www.rideonrailways.co.uk
www.theengineersemporium.co.uk
www.17d-miniatures.co.uk

■ Due to pressure on space we have swapped around the final two parts of Simon's series – the episode in which he describes his second locomotive, a rebuild of something rather unusual, will now appear next month.

Parts 1 to 3 of the series, describing the creation of the Apple Valley Railway, the building of its track and construction of a simple battery locomotive appeared in the August to October 2019 issues of **EIM**.



PHOTO 2:

Studding rods are added through holes drilled in the buffer beams.

PHOTO 3:

Wheel sets are fitted with bearings and bolted to the chassis rails.

PHOTO 4:

Finished wagon with couplings and a coat of varnish applied.

PHOTO 5: A complete flat wagon out in the garden

PHOTO 6:

Close-up of tanker; tank body was once a Calor gas bottle. Simple cross supports were shaped using a flap wheel in angle grinder to match curve of the tank.

A Midland 115 Class 'Spinner' in 5-inch Gauge

Boilermaking for Bruce on his first-ever live-steam locomotive construction project.

BY **BRUCE BOLDNER** Part three of five



Our Australian Miniature Boiler Code for copper boilers (AMBSC Code Part 1 Issue 8 – 2012) appears more strict than the code in the UK – not that I have ever perused the latter.

In order to conform with the minimum ligature spacing between the flue tubes within the boiler as required by our code, the diameter of the two superheater flues had to be reduced from 1-inch outside diameter to $\frac{7}{8}$ -inch. Accordingly the stainless steel superheater tubes had to be reduced from $\frac{3}{8}$ -inch to $\frac{5}{16}$ -inch outside diameter. The 14 boiler tubes remained at $\frac{7}{16}$ -inch outside diameter.

I've only driven my own Spinner, therefore have no idea whether there has been a reduction in power compared to those built to the original specification. But I doubt it would be noticeable – my Spinner has plenty of power. Also in accordance with our Code, firebox stays were increased per side from 41 to 59 plus an additional 14 per side to secure the butt straps holding the firebox extensions. I obtained a $4\frac{1}{2}$ -inch outside diameter seamless copper tube from Reeves, so at least a longitudinal butt strap requiring even more stays wasn't required.

I cut the tube to give equal fold-down extensions on each side to form the firebox. Cutting one side more deeply (as per the Evans plans) would have allowed the firebox wall on one side to achieve the full depth required. However the butt join on the other shorter side would have ended up on the concave curve of the boiler shell. So I opted for equal extension strips on both sides, enabling both butt straps to be fitted to a flat surface.

Firebox forming

Wooden formers were made from layers of MDF to form both the outer firebox walls from the boiler shell and



PHOTO 32-37: Stages in forming the firebox outer wrapper and inner firebox.

All photos in this feature by the author

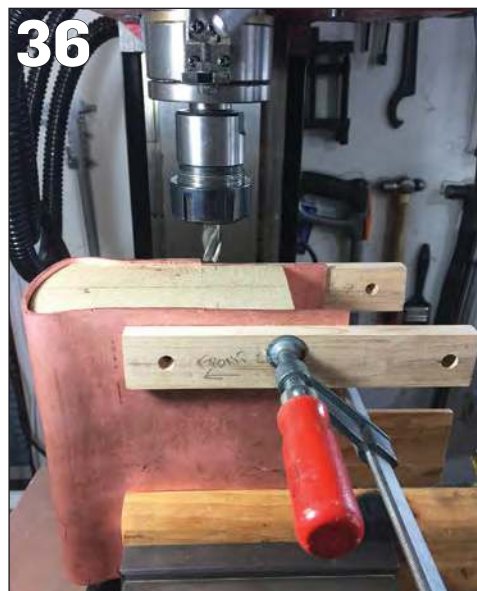




PHOTO 38:
Checking position
of inner firebox
to outer wrapper
with a spacer.

PHOTO 39:
Initial fitting
of firebox
outer wrapper
extension before
fitting butt strap.

PHOTO 40:
View inside of
palm stays.

PHOTO 41:
Boiler tubes
soldered between
the tubeplates.

PHOTO 42:
Drilling the stay
holes, including
extras required.

PHOTO 43:
Soldering up the
boiler – a long
drawn-out and
repetitive process.



the firebox itself. I used bronze screws to hold the firebox together for silver soldering (Photos 32-37).

The Australian boiler code also does not allow girder stays on the firebox crown, so these were replaced with 28 radial stays silver soldered to both firebox crown and the boiler shell above (Photo 38).

The lower stays through the backhead, firebox tubeplate/backplate and throatplate were increased from six to nine stays each (Photo 39).

A doubler plate was required to be silver soldered to the inside upper half of the backhead and palm stays were mandated from the inside of the backhead to the top of the boilershell either side of the rear safety valve (Photo 40).

Two $\frac{3}{16}$ -inch outside diameter longitudinal stays had to be secured between backhead and smokebox tubeplate. One of these was hollow and used for the blower.

Every bush had to be increased in area and the inner regulator dome completely redesigned, although the original Stroudley regulator still just managed to be squeezed in. All this to comply with the Australian copper boiler code. It got complicated!

At last, with fire tubes soldered between smokebox and firebox tubeplates (Photo 41) and all stay holes drilled (Photo 42), it was off to friend Mike Boddy's house. As I've never used oxy-acetylene before, I kept the boiler heated overall with a large soup-can sized propane torch, whilst Mike kindly did all the silver soldering with oxy.

A lengthy task

What a tiresome job boiler making is! We would solder all the stays, cool the boiler down a little with the hose (Photo 43) then place it in our pickle bath of citric acid and go and have a coffee for 45 minutes or so. We would then rinse it down, plug every orifice, paint a soapy water solution all over the inside and surrounds of the firebox, then pump it up with compressed air and watch for bubbles.

During the third enactment of this ritual, when bubbles appeared yet again, I felt like curling into the foetal position and lying down in a dark place for a couple of months. However Mike has an irrepressible positivism. "Come on, we'll get there! We'll just do it again!" And of course we did get there. Photo 44 shows Mike poised Van Gogh-like with his paint brush, impervious to my anguish.

I was nonplussed as to why the Martin Evans plans placed the reach rod (from the lifting arms of the expansion links to the screw reverser) at so high an elevation. The reach rod is supposed to be hidden beneath the



boiler cladding and yet ran alongside the apex of the outward curve of the outer firebox.

I thought it logical to lower the height of the screw reverser so that the reach rod ran alongside the concave lower section of the firebox. The centreline of the screw reverser is now $2\frac{13}{32}$ -inch above the top of the inner frame. It looks more prototypical in relation to the cab at this height too.



The boiler is a close fit between the frames, to the extent that it is not possible to extend the lagging on the boiler below the top of the inner frames. This and the trench in the lagging for the reach rod are shown in **Photos 45, 46**.

To clear both the boiler and the inside of the driving wheel, the reach rod must run directly above and in line with the inner frame. The reach

PHOTO 44: Bruce's friend Mike with the boiler after soldering.

PHOTO 45: Applying the lagging, with a trench for the reach rod.

PHOTO 46: Boiler in the frames, visible progress.

PHOTO 47: Drawing taped to backhead helps route pipework..

PHOTO 48: The pipework fitted inside the backhead.

PHOTO 49: Drilling out the injector castings.

PHOTO 50: Backhead view, sleeve fitted to reduce size of firehole.

PHOTO 51: Inside view of the sleeve in the firehole.

PHOTO 52: Making up the superheater tubes – right-angled tube sourced from fridge fittings.

rod had also to be filed at an angle on its inside face to conform with and achieve clearance with the curve of the boiler.

Full-size inspiration

As functional as the Martin Evans backhead is, I instead wanted to build a backhead resembling the full-size version as much as possible. I was very fortunate to discover some castings by Dave Noble which replicated a pair of early Gresham & Craven combined steam and injector valves. They weren't the exact models as found on the preserved Spinner at the National Railway Museum, but were very similar. I think Dave said they were the last two he had left. They didn't have all the fittings and the passages had to be drilled. However, he included an excellent article by Bob Raffan from a *Model Engineer* of 2003 which gave sufficient instructions. **Photo 47** shows Mike Boddy's drawing taped to the backhead, with **Photo 48** showing the actual pipework inside.

Having dispensed with an external turret, steam for the injectors is collected by pipes immediately inside the backhead extending from the apex of the boiler to the lower inlets seen in the mounting plates for the Gresham & Craven castings. When the valve is opened on one of the Gresham & Craven replicas, steam is directed via the fitting to the usual injectors beneath the cab floor.

The right-hand one delivers to a 25-ounce injector and the left one to an 11-ounce injector. Water is of course first delivered to the underfloor injectors via hand lever valves on the tender.

When the injectors pick up, their pressurised water input is admitted to the boiler via the top holes seen in the Gresham & Craven mounting plates. There is a ball valve inside the Gresham & Craven casting to prevent



water returning from the boiler. **Photo 49** shows a passageway being drilled in one of the G & C castings.

There are tubes inside the boiler from these upper holes, which run the length of the boiler to just behind the smokebox tubeplate, where the water is delivered via a fan pattern of holes, to avoid cooling the water around the firebox unduly.

Seen also on the drawing is an internal steam collection pipe which enters the blower stay via a banjo fitting. The blank just above and to the right of the left G & C mounting plate is the bush for the left horizontal boiler stay.

The boiler is initially filled via a clack screwed into the bottom right bush. The bottom left bush accommodates a clack from the tender mounted hand-pump. The other two holes, one above the other to the left of the regulator shaft bush, are for the sight glass.

Too big a hole

I belatedly realised that the Martin Evans firehole opening was too large to be covered by the scale top and bottom opening doors that I wished to replicate, so a copper firehole sleeve of 1⁵/₁₆-inch internal diameter was inserted into the old. The two screw



PHOTO 53: Fly-cutting saddle for the smokebox...

PHOTO 54: ...and the rear safety valve cover.

PHOTO 55: Boring out the chimney proved a challenging job.

holes at the top retain the scratchbuilt door fixing plate. The screws are subsequently hidden behind the top opening door (**Photos 50, 51**).

The backhead was sheathed with a thin copper casing, embossed to simulate rivets, then painted potbelly black. Both blower valve and regulator spindle are sealed with O-rings. Mike Boddy made the water sight glass with offset blowdown to clear the fire door shelf, as nothing suitable was commercially available. Smallish-sized lumps of coal are administered using a 2ft long shovel with stainless steel shaft.

Stainless steel radiant superheater

elements extend fully into the firebox reaching to the inner backhead, with the arrowheads neatly tig-welded by fellow club member Chris Murray. The right-angled tubing into the header was sourced from copper refrigeration fittings (**Photo 52**).

It was not as tenuous as it looks to fly cut the base of the rear safety valve cover (**Photo 53**), smokebox saddle (**Photo 54**) or the large steam dome. However, boring the chimney (**Photo 55**) was a little hair-raising, as it kept coming loose on the mandrel! **EIM**

NEXT TIME: Bruce works on the platework and tender.



2019 Midlands Model Engineering Exhibition

In two reports concluding his coverage, John focuses on the display classes and club stands.

BY JOHN ARROWSMITH



PHOTO 1: Hereford SME's Nigel Linwood receives the Club Shield certificate from show organiser Chris Deith.

PHOTO 2: Second in the Club Shield went to Melton Mowbray SME.

PHOTO 3: 70th birthday display by members of Rugby SME.

PHOTO 4: Marine craft of every description on the Knightcote MBC stand

PHOTO 5: 10¼-inch gauge Royal Scot on the Society display.

PHOTO 6: Splendid mix of locos and rolling stock on the Gauge 1 stand.

The Club stands and Display sections of the exhibition were a main feature again this year and provided a veritable feast of good quality model engineering covering just about every topic you could think of. The competition for the Club Shield was keenly contested and is an excellent reward for all the hard work that goes into attending the show. All clubs and societies are entitled to vote so being judged by your peers is particularly pleasing. Winners this year were the Hereford Society of Model Engineers (**Photo 1**) with the Melton Mowbray Club in second place (**Photo 2**) and joint-third winners the Rugby ME (**Photo 3**) and Knightcote Model Boat Club (**Photo 4**).

As visitors entered the main exhibition hall they were greeted by a large model of an unrebuilt Royal Scot locomotive (**Photo 5**) displayed by the 10¼-inch gauge Society, actively promoting the gauge and railways.

Opposite in complete contrast was the display by the Gauge 1 Model Railway Association (**Photo 6**), showing off the eclectic mix of models available in this gauge.

A rake of nine classic Pullman carriages in 5-inch gauge (**Photo 7**) attracted much attention. Part of a batch of 18 vehicles built by Brent Hudson and Ben Lyons they were full of working detail and excellent fittings. The couplings alone were almost works of art and have been load tested to check their strength with what was the equivalent of pulling a full-size Land Rover so there would be no problem in service.

A number of anniversaries were





celebrated in the exhibition and these again provided a superb collection of models to be admired. Polly Model Engineering celebrated 20 years of operation with a fine display of the firm's locomotive range (**Photo 8**). Meanwhile the Rugby Society of Model Engineers celebrated their 70th anniversary with a large stand displaying a very wide range of locomotives, stationary engines, traction engines and equipment which showed the versatility of the club (**Photo 9**).

Meccano is still a popular modelling system and the Midland Meccano Guild celebrated the 130th Anniversary of the Eiffel Tower with a display of models commemorating the opening date in 1889 (**Photo 10**).

Alongside the club stands, excellent models were shown in the various Display classes. Regular visitors to the exhibition will have seen the excellent 5-inch gauge BR 9F 2-10-0 (**Photo 11**) being built by Bob Sheppard, which has progressed steadily over the years. This year it had the boiler and cladding fitted and the tender chassis attached. This will be an outstanding example of this BR prototype when it is completed. I hope Geoff enters it in Competition Class 3 when it is finished.

Alongside the 9F was another excellent example of a popular locomotive, an LNER A4 'Golden Plover' in 5-inch gauge owned by Jeremy Buck (**Photo 12**).

Unusual offerings

A rare model of a American 'Galloping Goose' (**Photo 13**) was prominent in Display Class 3. Owned by Stuart Brown, it was a well-made model capturing the atmosphere of these unusual railway machines.

Ian Matthews' 2-inch scale Clayton underframe steam lorry is still under construction and showing some good workmanship (**Photo 14**).

Attractive boats on display included the well-rigged French Navy Schooner 'La Toulonnaise' (**Photo 15**) built by Trevor Orton and showing the delicate work needed for a small-scale ship of this type.

In contrast the twin grasshopper high-pressure water pump (**Photo 16**) ▶

PHOTO 7:

Part of a rake of nine Pullman carriages in 5-inch gauge.

PHOTO 8:

Two decades of supplying locos was celebrated by Polly Model Engineering.

PHOTO 9:

Stationary engines on the large Rugby SME stand.

PHOTO 10:

Celebrating 130 years of the Eiffel Tower by the Midlands Meccano Guild.

PHOTO 11:

2-10-0 BR Class 9 built by Bob Sheppard in 5-inch gauge, displayed in Class 3.





PHOTO 12: Jeremy Buck's 5-inch gauge A4 resplendent in LNER Garter Blue livery.



PHOTO 13: Rare model in 7 1/4-inch gauge of an American Rio Grande Southern 'Galloping Goose' railcar.

PHOTO 14: In Display Class 6 was this very nice Clayton undertype steam lorry in 2-inch scale by Ian Matthews.

PHOTO 15: A 1/75 scale model of a French Navy Schooner 'La Toulonnaise' shown by Trevor Orton.

PHOTO 16: Laurence Drybrough built this 1/30 scale model of a Twin Grasshopper HPO pump, for Display Class 5.

PHOTO 17: Well-made small oscillating stationary engine by David Rhodes in Class 5.

PHOTO 18: Magnificent Fowler showman's engine and crane built by Davinda Matharu in 2-inch scale.

PHOTO 19: 4-inch scale Garrett traction engine under construction by Richard Betts.



built by Laurence Drybrough was an excellent example of this type of machine. The small oscillating engine (**Photo 17**) built by David Rhodes also showed fine attention to detail.

The display by the Model Steam Road Vehicle Society reflected the fine selection of traction engines and steam road vehicles at the show this year, topped by the wonderful 2-inch scale Fowler showman's engine with rear-mounted crane (**Photo 18**) built by Davinda Matharu. Beautifully made and finished it was a real eye-catcher.

Much too big for the display table was the 4-inch scale Garrett traction engine (**Photo 19**) under construction by Richard Betts. It is coming along nicely and will be a fine model when completed, hopefully another future competition entry.

Young attractions

Outside MSRVS members were also involved with the Fosseway Steamers providing additional operating experiences for visitors. At least one young man who had never been to a model engineering exhibition before was given the opportunity to try out a traction engine ride with Les Riley on his 4-inch scale McLaren road locomotive (**Photo 21**). I don't know who was the most excited, his grandparents or the youngster.

This involvement with young people was repeated across the rally field where I came across 12-year-old Arthur Haynes from near Wolverhampton, presenting his little display of his own Mamod-type models in steam. He also drove dad's 3-inch scale Aveling & Porter traction engine with great confidence and skill. This emphasises what I have commented many times in these pages, that the traction engine members appear to encourage young



PHOTO 20: Busy making kindling for future use was Richard Kew's 6-inch Ruston Proctor SD tractor and saw bench.

PHOTO 21: First time on a traction engine, this young man was thoroughly enjoying himself on Les Riley's 4-inch scale McLaren.



people into their ranks much more readily than traditional model engineering clubs, but I cannot find out why this is. Perhaps readers could enlighten me through their letters to the editor?

A number of other demonstrations and activities outside included wheat grinding and timber sawing using traction engines in steam (**Photo 20**). Noel Shelly's popular foundry sessions

were always well attended as were the Gas Turbine demonstrations which showed off the capabilities of these very high-tech machines, also featured in a comprehensive display in the marquee. And the Coventry MES again operated their portable track for rides using a locomotive supplied by Polly Engineering.

Back inside again and other activities on offer included Chris

All photos in these features by the author

Robinson's demonstrations of different aspects of gear cutting using a modified Jacobs gear cutting machine, this attracting a lot of attention. Peter Stevenson shaped sheet metal, in particular the complex shapes for Collett safety valves, while regular contributor Derek Brown was showing how drills down to No. 80 can be sharpened using a simple jig for the small ones and four-facet grinding for the larger ones. **EIM**

Club skills to the fore...

The individual Club displays at the Midlands show again demonstrated that despite all the rumours to the contrary the model engineering clubs appear to be in a healthy state.

Club Shield winner the Hereford Society exhibited an excellent mix of models in many gauges and prototypes. The club's Young Engineers section (**Photo 22**) is very active, exhibits ranging from a simple Gauge 1 railway wagon built by Jace Guy to the 7¼-inch gauge chassis under construction by James Knight. Jim Sinclair's 5-inch gauge Schools class 4-4-0 was well constructed and made quite an impression.

The excellent display by Club Shield runner-up Melton Mowbray & District ME included Stewart Jackson's first-class example of a 5-inch gauge Shay Type B locomotive, a 3-cylinder engine fitted with Stephenson's valve gear (**Photo 23**).

Norman Smedley's excellent 3-inch scale Fordson Speed Six is still

PHOTO 22: Good variety of young engineers' work on the Hereford SME display.

PHOTO 23: A superb example of a 3-cylinder Shay logging locomotive in 5-inch gauge by Stewart Jackson.



CLUB NEWS SPECIAL



under construction. The immaculate finish of the multi-tube boiler, shown alongside, really stood out.

The Knightcote Model Boat Club display included fine examples of marine craft ranging from modern



PHOTO 24: Ron Head's useful loco building stand on the City of Oxford SME display.

PHOTO 25: Lots of interest on the Erewash Valley MES display, from locos to Welshpool's Raven Square station.

PHOTO 26: A selection of larger locomotives featured on the stand of the National 2½-inch Gauge Association.

PHOTO 27: Part of the Coventry MES contribution to the exhibition.

PHOTO 28: A small but powerful display put on by the 7¼-inch gauge Society.

PHOTO 29: Colourful display by the Nottingham SMEE included this diesel shunter loco in a rainbow colour scheme.

submarines to old sailing ships.

A regular contributor to the exhibition is the City of Oxford SME, a highlight of the well laid-out stand being the versatile and useful locomotive building stand built by Ron Head (**Photo 24**).

A regular contributor to this event is the Erewash MES (**Photo 25**). Fine models included a well-built example of the refurbished station building at Raven Square on the Welshpool and Llanfair Light Railway which I hope our worthy editor (a W&LLR trustee) spotted during his visit to the show (*I certainly did* – Ed).

Smaller scales

The National 2½-inch Gauge Association's large selection of locomotives (**Photo 26**) gave visitors the opportunity to see what can be achieved in this gauge. An equally impressive display by the Gauge 3 Society showed the scenic side of the 2½-inch gauge scale.

The Society of Ornamental Turners demonstrated the different techniques required to achieve the intricate surface finishes so essential to their work. As always the Coventry MES presented a comprehensive selection of members' work (**Photo 27**) as well as operating a small workshop to produce parts for a small oscillating engine, 'Wig Wag'.

A small display by the 7¼-inch Gauge Society provided plenty of information for potential members as well as demonstrating the wide attractions offered by this larger gauge (**Photo 28**).

A colourful selection of models on the Nottingham SMEE stand included a little Class 08 Shunter almost in rainbow colours (**Photo 29**).

The Guild of Model Wheelwrights produced a colourful display of those intricate and fascinating models of yesterday's transport (**Photo 30**).

More marine craft on the Kingsbury Water Park MBC stand included a very nice model of the paddle steamer 'Waverley' along with some well built coasters and lifeboats..

Centrepiece of the comprehensive display by members of the Bromsgrove

**PHOTO 30:**

Colourful wagons on the display by the Guild of Model Wheelwrights.

PHOTO 31:

Well-built loco repair shop and numerous fine models made up the Bromsgrove SME display.

PHOTO 32:

Superb example of a GWR King class loco on the Birmingham SME stand.

PHOTO 33:

Wolverhampton MES provided a varied display.

PHOTO 34:

Part of the large SMEE display of archive models.

PHOTO 35:

I/C Engine Builders Group showed valveless pulse-jet engine that was built by Harry Williams.



a 3-inch scale steam roller which is under construction, and a well-made boiler plant displaying some truly excellent pipework.

Among the excellent examples of internal combustion engines on the IC Engine Builders Group stand the new model of a valveless pulse jet by Harry Williams attracted a lot of attention with Harry always busy explaining the

principles and demonstrating its operation (Photo 35).

It only remains for me to offer thanks to all who contributed in any way, even if I haven't given you a mention, all your efforts were really appreciated by the organisers and all the visitors because you all made for another excellent Midlands Model Engineering Exhibition. **EIM**



JANUARY DIARY

EVERY SUNDAY

(Weather permitting)

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

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

Fylde SME Public running at Marsh Mill, Thornton Cleveleys, FY5 4AB from 1pm.

Kings Lynn & District SME public rides, Lynnsport Miniature Rly, PE30 2NB, 11am-3pm

North Wilts ME public running, Coate Water Railway, Swindon, SN3 6AA

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

Tyneside SME Members Day, Exhibition Pk, Newcastle NE2 4AA

Urmston DSME Running Day, Abbotsfield Pk, Manchester M41 5DH 11am

Wigan MES public rides, Haigh Woodland Park, School Lane, Haigh, PM

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

EVERY WEDNESDAY

(Weather permitting)

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

Kings Lynn & District SME public rides, Lynnsport Miniature Rly, PE30 2NB, 11am-3pm

Tyneside SME Members Day, Exhibition Pk, Newcastle NE2 4AA

01 Grimsby & Cleethorpes ME public rides, Waltham Windmill, DN37 0JZ

01 Lancaster & Morecambe ME Informal Running (weather permitting) Cinderbarrow, Tarn Lane, near Yealand Redmayne

01 Norwich DSME Members Day, Eaton Park, NR4 7AU, 10am

01 Romney Marsh ME New Year's Day Track Meeting, Rolfe Lane, New Romney TN28 8JL, 11am

01 Southampton SME Frostbite Running, Riverside Park, SO18 1PQ.

01 Wirral ME New Year's Day Steam-up (weather dependent), Royden Park, Frankby.

02 South Lakeland ME informal meeting, Pavilion, Lightburn Park Ulverston, 7.30pm

03 Portsmouth ME meeting, 'The Mighty Electron', Tesco, Fratton Centre, Portsmouth, 7.30pm

03 Vale of Aylsebury ME Video Evening, Community Centre, Prebendal Ave, HP21 8LF:

04 Isle of Wight ME Open Afternoon, Broadfields, Cowes PO31 7NN, 1.30pm

04 SMEE meeting, 'The 20th century battleship & its guns' by Alastair Milne, Marshall Hse, London SE24 0HW, 2.30pm

04 Tiverton ME running day, Worthy Moor, Rackenford

05 Wagga Wagga SME public running, New South Wales, Australia, 10.30am

07 Canterbury SME (New Zealand) meeting, Halswell Domain, 7.30pm

07 Romney Marsh ME Meeting, An Evening with Andy Nash, Rolfe Lane, New Romney TN28 8JL, 7.30pm

08 Bournemouth DSME meeting, Tech-chat, Bridge Community Centre, Littledown Centre, Bournemouth, BH7 7DX 7.30pm

08 Bradford ME Meeting, Bits & Pieces Evening, Saltaire Methodist Church, 7.30pm

08 Leeds SME meeting, members' projects, Mid Yorkshire Golf Club, Darrington, WF8 3BP, 7.30pm

08 Worthing SME New-Year Steam-up, Field Pce, Durrington, BN13 1NP

09 Worthing SME Club meeting, "It's a Gas", Field Pce, Durrington BN13 1NP, 7.30pm

10 Tiverton ME meeting, talk by hydraulic engineer Ed Wilson, Old Heathcoat Community Centre, EX16 5JJ 2.30pm

14 Romney Marsh ME Members Social Afternoon, Rolfe Lane, New Romney TN28 8JL, 2pm

14 Southampton SME evening meeting, Riverside Park, SO18 1PQ.

15 Bristol SME Meeting, 'TSR2 the grandfather of Tornado' by Jock Heron, Begbrook, Stapleton, BS16 1HY, 7.30pm

16 Bournemouth DSME meeting, Bridge Community Centre, Littledown Cntr, Bournemouth, BH7 7DX 7.30pm

16 Wirral ME club night, WI Hall, Thornton Hough, 7.20pm

17 London Model Engineering

19 Exhibition, Alexandra Palace, details at www.londonmodelengineering.co.uk or centre pages of this issue

18 Isle of Wight ME Members' Day, Broadfields, Cowes PO31 7NN, 10am

18 SMEE Engine Builders Grp model running, including G1, Marshall Hse, London SE24 0HW, 2.30pm

19 Tiverton ME running day, Worthy Moor, Rackenford

19 Wagga Wagga SME public running, New South Wales, Australia, 10.30am

20 Lancaster & Morecambe ME meeting, Cinderbarrow, Tarn Lane, near Yealand Redmayne

21 Grimsby & Cleethorpes ME members' meeting, Waltham Windmill, DN37 0JZ 7.30pm

21 Model Steam Road Vehicle Society meeting, Longford Village Hall, Gloucester, GL2 9EL 8pm.

21 Romney Marsh ME meeting, 'The Silver City Story', Paul Ross, Rolfe Lane, New Romney TN28 8JL, 7.30pm

22 Leeds SME meeting, 'The First Train in Spain from Warrington' by Richard Gibbon, Mid Yorkshire Golf Club, Darrington, WF8 3BP, 7.30pm

23 Bournemouth DSME IC & Stationary Engine Group meeting, Tech-chat, Bridge Community Centre, Littledown Centre, Bournemouth, BH7 7DX 11am

23 Worthing SME Club meeting, Field Pce, Durrington BN13 1NP, 7.30pm

25 SMEE Rummage Sale, Marshall Hse, London SE24 0HW, 2.30pm

25 Worthing SME Club Social Evening, Field Pce, Durrington 7pm

28 Romney Marsh ME Members Social Afternoon, Rolfe Lane, New Romney TN28 8JL, 2pm

28 Wigan & DMES Members' Only meeting, Ince Methodist Church, WN1 3HB, 7.30pm

Don't forget to send in your club's 2020 diary dates to the address on page 3!



London show is at Alexandra Palace on 17th-19th of this month.

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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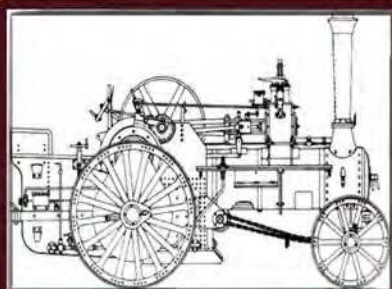
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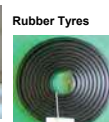
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