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MODEL ENGINEER & WORKSHOP

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Volume: 234, Issue: 4764, May 2025

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INSIDE this packed issue:

A Gearcutting Clutch for the EMCO Compact 5 • Setting up an IMO Inverter • The BR Standard 2-6-0 Mogul • Reader's Tip: Make an Elegant Clamp Screw • Design Challenge - an Exhaust Shroud • A Corliss Valve Steam Engine • Templates for Drilling Angles • The Stationary Steam Engine • Centre Punches and Rivet Snaps • A GWR Pannier Tank in 3 1/2" Gauge • Boring in the Lathe

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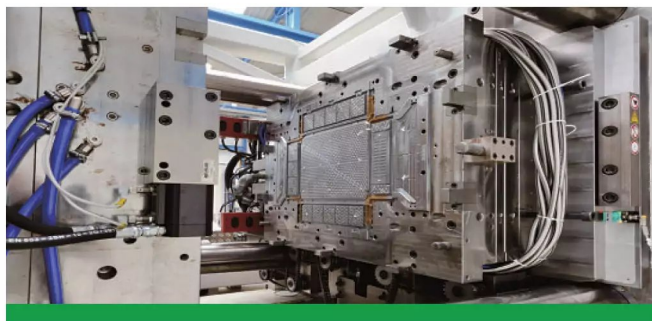
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EDITORIAL

Editor: Neil Wyatt
Deputy Editor: Diane Carney
Designer: Darren Hendley
Illustrator: Grahame Chambers
Publisher: Steve O'Hara

By post: Model Engineer & Workshop,
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Telephone: 01507 529589

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Telephone: 01507 529529

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ADVERTISING

Group Head of Investment

Model & Tractor Publications

Mason Ponti

Email: mason@talk-media.uk

Telephone: 01732 920499

INVESTMENT MANAGER

Karen Davies

Email: karen@talk-media.uk

Telephone: 01732 448144

Talk Media, The Granary, Downs Court,
Yalding Hill, Yalding, Kent ME18 6AL

PUBLISHING

Sales & Distribution Manager: Carl Smith

Head of Marketing: Charlotte Park

Commercial Director: Nigel Hole

Publishing Director: Dan Savage

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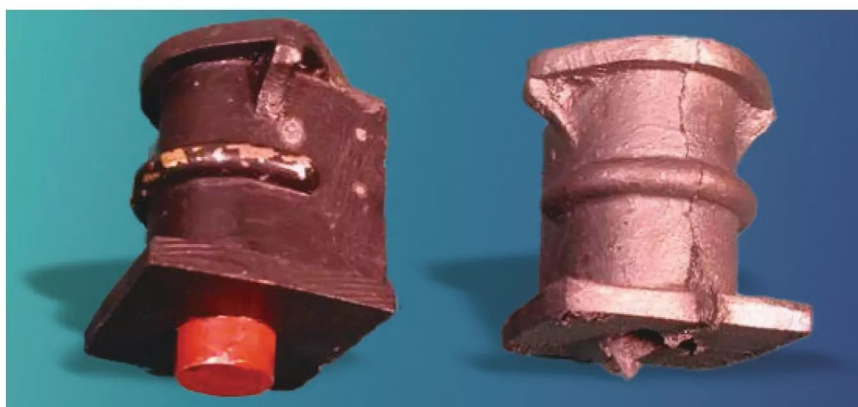


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16 May 2025



SMOKE RINGS

On the Editor's Bench



As promised, this issue contains a brief
article on my experience of a metal 3D
printed part, and I see that this month's
Club News also features a model with
parts made this way. Is using metal 3D
printed parts 'cheating'? For most of us,
workshop activity is generally done for
pleasure, so the concept of cheating
doesn't really apply – we can use what-
ever techniques or aids we wish.

As far as model engineering is
concerned, in the past it wasn't unusual
to make patterns for parts of tools or
models and get them produced by a

local foundry; I don't think that was
ever classed as 'cheating'. The skills
to produce an accurate 3D model in a
CAD program are very different from
those needed to make a good pattern,
but I would argue that both require skills
and expertise. Indeed, from my own
experience, a complex 3D model can
take more work than a simple pattern.

As far as competitions are concerned,
the answer is simply that full disclosure
should be made for any bought in parts
or services, and so the model may be
judged on the work put in by the builder.

British Association Screw Threads

Incidentally, my resumption of
modelling has led to a modest
flurry of orders from some of 'our'
suppliers. Notable service was had
from EKP supplies who managed
to divert a batch of BA fixings to my
current address, despite their system
retrieving my old one. BA screw
sizes may seem very old fashioned
to younger readers, used to metric
fixings, however, despite being agreed
in 1884 by the British Association they
are actually a metric standard. The
largest size is 0BA at 6mm diameter,
and each further size is 0.9 times
the size of the previous, rounded
to 0.01mm. In practice, this means
modellers needing scale size fixings
can choose one within 5% (and often
better) of actual size.

Many sizes are available with the

choice of 'one size smaller' hexagons
which can better represent the propor-
tions of full-size fixings. As my model
requires 12 and 14BA fixings (1mm top
diameter) I find myself wishing I had
'one size smaller' fingers!

Neil



Neil Wyatt
Editor



Diane Carney
Deputy Editor



**CJ18A Mini Lathe - 7x14 Machine
with DRO & 4" Chuck**

SPECIFICATION:

Distance between centers: 350mm
Taper of spindle bore: MT3
Spindle bore: 20mm
Spindle speed: 50-2500mm
Weight: 43Kg

Price: £595



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38mm spindle bore**

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Distance between centers: 400mm
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Spindle bore: 38mm
Number of spindle speeds: Variable
Range of spindle speeds: 50~2500rpm
Weight: 65Kg

Price: £1,185



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Distance between centers: 750mm
Taper of spindle bore: MT4
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Number of spindle speeds: Variable
Range of spindle speeds: 50~2500rpm
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Price: £1,904



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Model No: AMAVM25LV (MT3) / (R8)
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T-slot size: 12mm
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W 3 AXIS DRO- Price: £955



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Graham Meek presents a final iteration of his screwcutting clutch design, this version is adapted to fit the Compact 5 lathe.

15 A GWR Pannier Tank in 3 1/2 Inch Gauge

Geralds Martyn describes how to make the brakes for his model tank engine.

21 A Leather Belt-Joining Jig for a Threshing Machine

Ian Couchman's Thresher featured in ME several years ago. After solving some other teething problems, he made this jig for use away from the workshop.

26 Setting Up a Variable Speed Motor Drive

The popular IMO Cub has been replaced, here's Joe Jordan's guide to setting up the new SD1 inverter drive.

29 Quick Notes from the Workshop

We explain the differences between some similar looking hand tools.

30 The Midlands Garden Rail Show 2025

John Arrowsmith went to the show that focuses on medium sized model railways.

36 A Resin Exhaust Shroud

Marcus Bowman took on a design challenge for a part that would traditionally have been made by injection moulding.

46 My Life in Miniature!

Mark Noel has turned his engineering ingenuity to making miniature accessories for doll's houses.



54 Working on the Lathe: Drilling and Boring

This month Neil Raine looks at how to ensure boring tools cut freely.

62 A Tandem Compound Mill Engine

David Thomas moves onto the governor, making several small and accurate parts.

68 The BR Standard 2-6-0 Class 4 Standard Engine

Doug Hewson introduces the boiler design for the 5" gauge Mogul..

74 COVER FEATURE - 3D Printed Metal Parts

Replacing castings with 3D printed metal parts is now feasible for us, says Neil Wyatt.

76 Beginner's Workshop.

More on difficult drilling – Geometer illustrates some simple jigs to facilitate accurate hand drilling.



Subscribe today!

Get your favourite magazine for less – delivered to your door!
See pages 24-25 for details!

Regulars

3 Smoke Rings

The Editor's round-up of what's on his workbench.

18 On the Wire

This month's report highlights how autonomous vehicle control is becoming ever more common.

20 Readers' Tips

This month our winner has a traditional style tip for making elegant clamping screws. Send your tips to meweditor@mortons.co.uk, and you could win a prize.

42 Club Diary

Our month-by-month guide is full of interesting club events around the UK.

44 Postbag

The contents of the last issue raised a lot of interesting responses from our readers. Send the editors your letters at meweditor@mortons.co.uk.

77 Club News

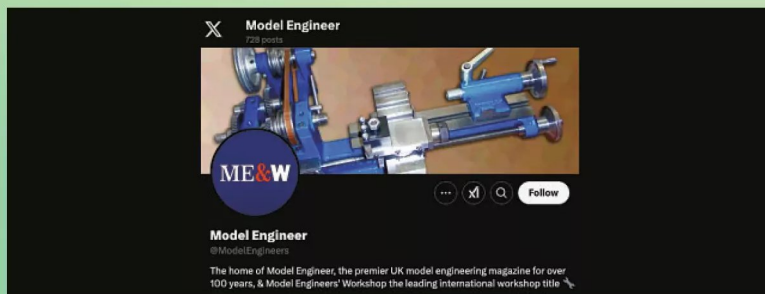
Geoff Theasby with his monthly round up of what's been happening at model engineering clubs across the world.

80 Readers' Classifieds

Our regular selection of readers free advertisements with more great machinery on offer.

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Extra Content!

Your magazine is growing and changing into Model Engineer & Workshop. Find out more and let us know what you would like to see in the new, larger magazine at: www.model-engineer.co.uk/forums

Visit the forum for another perspective on fitting an inverter drive to a lathe: <https://tinyurl.com/3snhru5w>

Hot topics on the forum include:

Beginner with newly bought lathe – many questions started by ell81. Useful advice here for anyone who has bought an older lathe second hand.

Bassett Lowke "Eclipse" started by JasonB. Recreating an old design for a simple 'marine' steam engine.

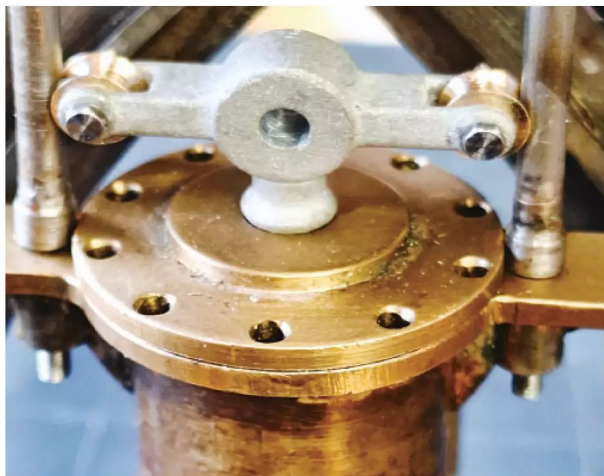
Stripped aluminum threads. Now what? started by brucemc777. Several different approaches to repairing stripped out threads.

Come and have a chat!

As well as plenty of engineering and hobby related discussion, we are happy for forum members to use it to share advice and support. Come and join us – it's free to all readers!

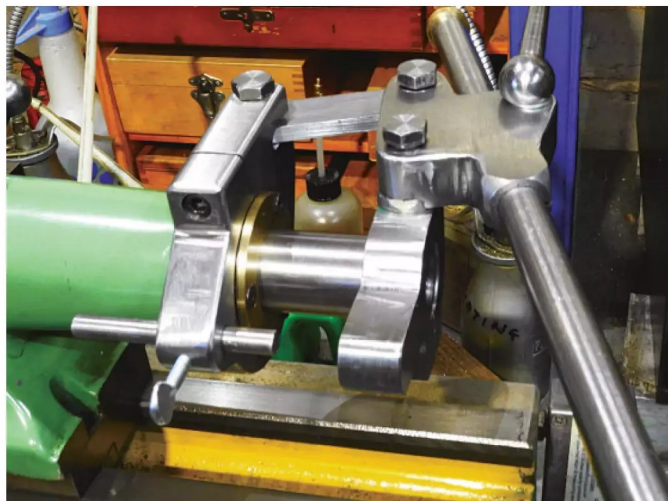


On the Cover



Our cover features a crosshead 3D printed in aluminium alloy for a model stationary steam engine. Read more from page 74.

Next Issue



In our next issue, David Haythornthwaite details a lever tailstock for the Myford Super 7 lathe.

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CIG81220	6.1 x 3.7 x 2.5m	140613576	£385.00	£466.80	£462.00
CIG81224	7.3 x 3.7 x 2.5m	140613578	£479.00	£586.80	£574.80
CIG1432	9.7 x 4.3 x 3.65m	140613594	£1079.00	£1318.80	£1294.80
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CHDB500	150	060710492	£119.98	£143.98	
CBB250	250	060710491	£169.98	£203.98	

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CWB2001P	2000x650x865	040317809	£279.98	£335.98	
CWB2000D	2000x650x880	040317807	£309.00	£370.80	

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3/4	4 pole	010210430	£104.99	£125.99	
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3	2 pole	010210465	£154.99	£185.99	
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Over the years **Graham Meek** has adapted his screwcutting clutch design to several different types of lathe. He found himself with a final design challenge and the solution will greatly benefit Compact 5 users.

An EMCO Compact 5 Screwcutting Clutch

PART 1

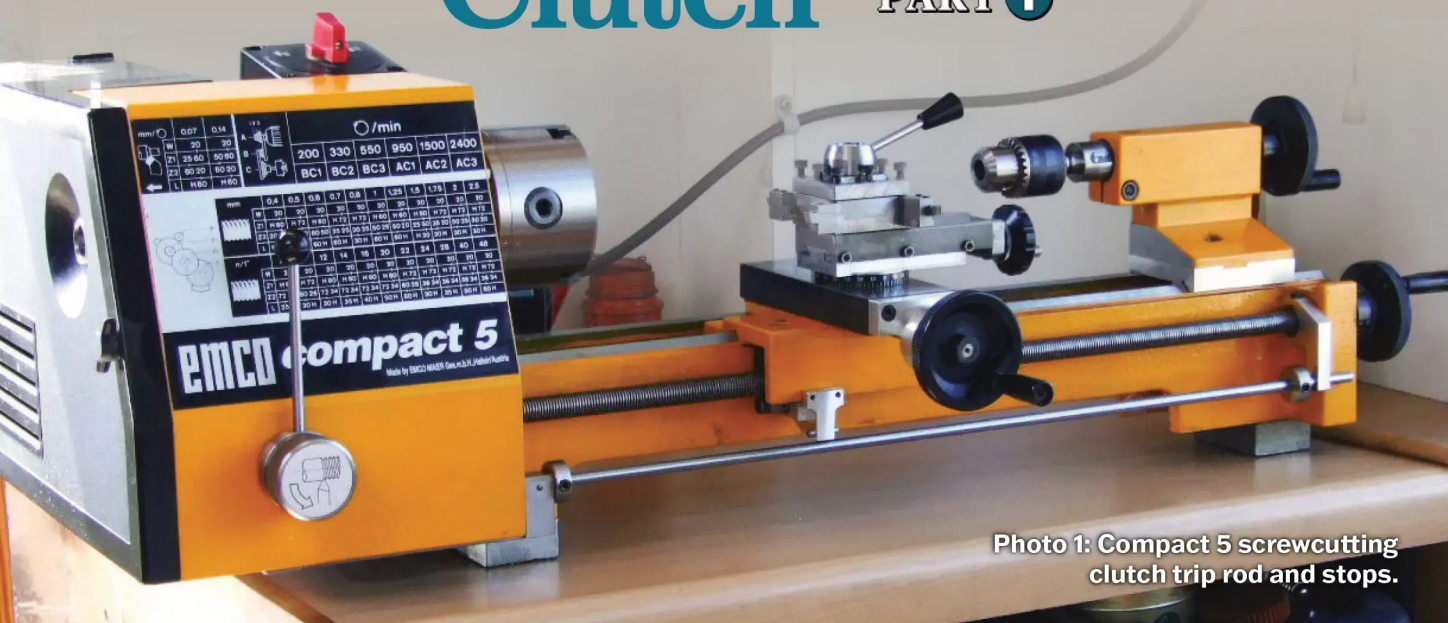


Photo 1: Compact 5 screwcutting clutch trip rod and stops.

It had been my firm belief that the screwcutting clutch for the Maximat Super 11 was going to be my last screwcutting clutch design (*Model Engineers' Workshop* 304 – 306). Having decided in early 2022 to downsize to smaller equipment, however, the race was on to get my Compact 5 in a condition which would suit my future needs. I am not going to describe the operation or construction of the clutch in detail as this has been covered by my earlier articles. The best description of its use and function is in *MEW* 261 – 263, where I discussed my version for Myford ML7 and S7 lathes. This article covers specific changes to suit the Compact 5. In brief, the clutch is operated by two stops on an actuating rod beneath the apron, **photo 1**, that operates a repeatable dog clutch within the lathe gearbox, **photo 2**. The drawings for the clutch, **figs 1-7**, will

be published over the two parts of this article. Rendered images kindly produced by John Slater should help you understand assembly of the clutch, **renders 1-5**.

Once you have had the luxury of a screwcutting clutch it is a hard thing to have to do without, especially as I had waited 30 years to fit the Maximat version and given the large amount of screwcutting that I do.

The Compact 5 leadscrew and carriage are permanently engaged, i.e. no clasp nuts; screwcutting at 200 rpm and relying on switching off the motor at just the right moment is not my idea of fun. There was always the alternative of using a mandrel crank handle but given my muscle problems, this was ruled out in favour of a powered solution.

The Compact 5, whilst having a large, cavernous void inside the belt guard,

has the screwcutting gear train driven from the outer end of the mandrel. All previous designs have had the gear train close to the headstock and it has been a struggle to get everything in with this design. This seems a contradiction, given the space available. While the void could accommodate a robustly designed dog clutch assembly easily, getting the drive to the dog clutch and back to a position as close to the original mandrel gear was a different matter. This was due mostly to the large mandrel pulley being in the way. Things would have been a whole lot easier if the largest pulley diameter was nearer the headstock.

There proved to be two further flies in the ointment. The first was the fact that the mandrel gear, which is machined integral with the spindle, is an oversize gear. This gear also doubles up as the spline for the drive pulley. The outside

and pitch diameters of this gear are a lot larger than they should be for a standard 20 tooth gear of No. 1 Module (1 Mod). At 23.75mm outside diameter it is a full 1.75mm larger than the 22mm outside diameter of a standard 20T gear. This necessitated working backwards to find the true pitch diameter of the gear in order to lay-out the gear centres to and from the dog clutch.

The second was the leadscrew needs to be free to rotate when manually feeding the carriage along the bed using the leadscrew handle. This means the leadscrew engagement knob used by Emco for fine feeds and screwcutting has to be retained in one form or another, otherwise, when traversing the carriage along the bed manually, the operator would have to work against the gears in the quadrant drive train. This additional load is not a good thing to have to deal with when trying to establish a dimension, as the momentum from the moving gears can quite easily take the leadscrew past the desired position. It is a bit like the old friction drives which were found in old toy cars and the like.

I felt the location of the Emco engagement knob was ideal for the screwcutting clutch operating lever. This position is not unlike that on the Hardinge HLV toolroom lathe, the *crème de la crème* of screwcutting lathes. Some way of combining the two functions at this point was needed.

Work as always started with the main body, which went according to plan until it came to do a dummy fitting on the machine. It was impossible to locate the main body due to the M6 tapped bracket welded to the inside of the headstock sheet metalwork being in the way. This can be clearly seen in **photo 3**, which also shows the standard gear train set-up and the cavernous space. Taking the bracket off could have been an option, but those of you who have followed my writings in the past will know that this is not an option I would take. There was nothing for it but to make the main body in two parts, **photos 4, 5 and 6**. Luckily the existing main body could be salvaged for one of the halves.

A 0.25mm shim is drawn up to be fitted between the main body and the lathe bed. This is to fine tune the clearance between the Tufnol idler gear and the circlip which retains the mandrel pulley. Whether this is needed, or not, all depends to a large extent on the position of the headstock on the bed. While it could be possible to slacken the headstock and slide it along the bedways, towards the tailstock, this was an option that I decided I did not want to take. I am a firm believer in 'leaving well alone', especially when

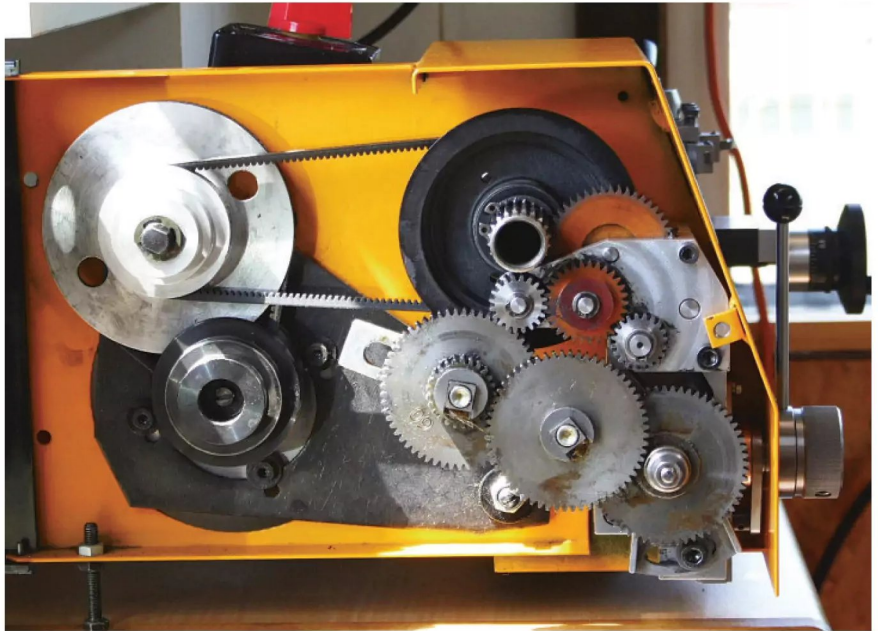
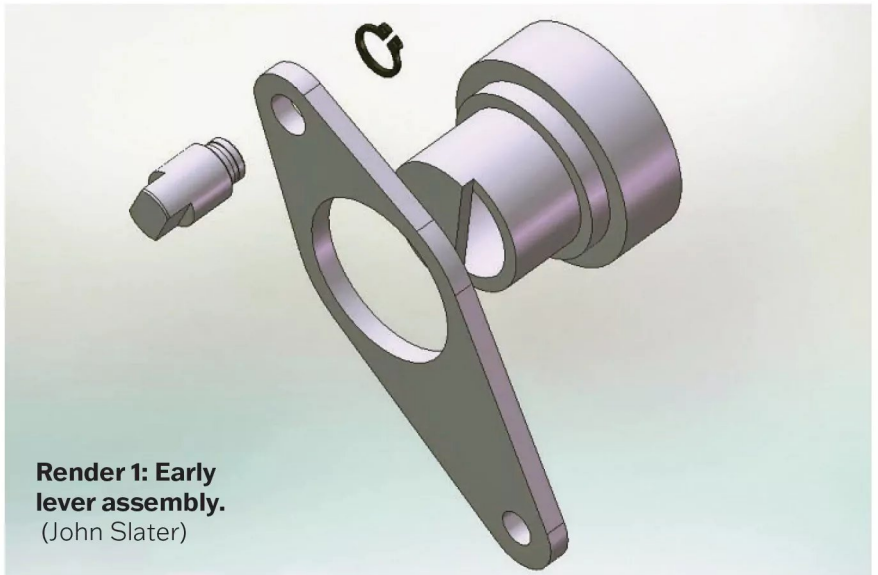
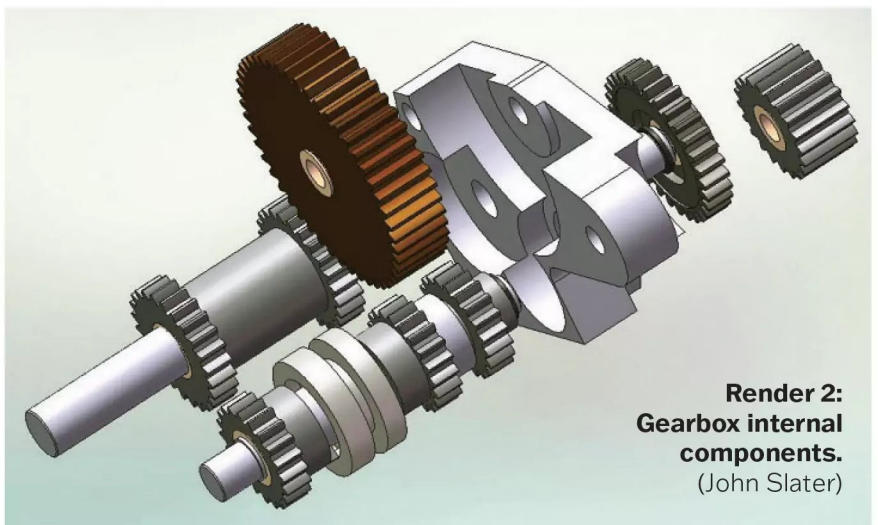


Photo 2: Gear train with the clutch fitted at right.

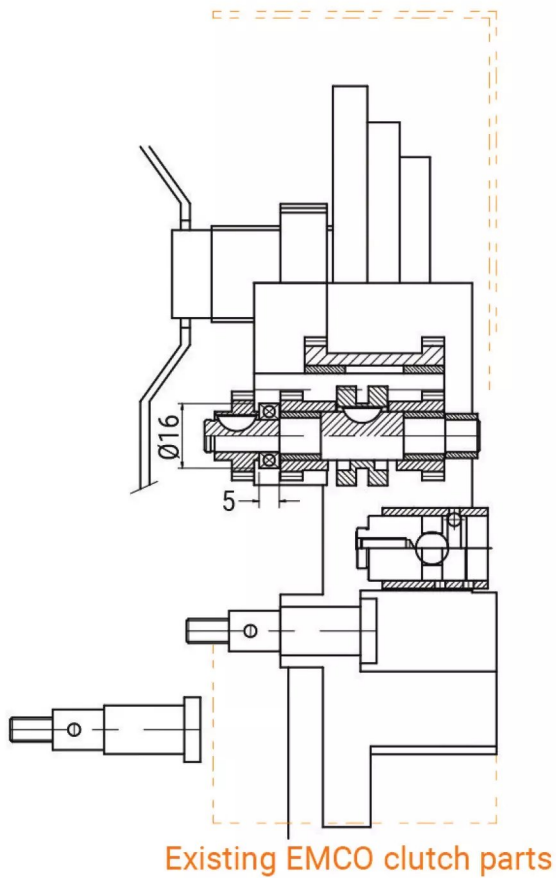


Render 1: Early lever assembly.
(John Slater)

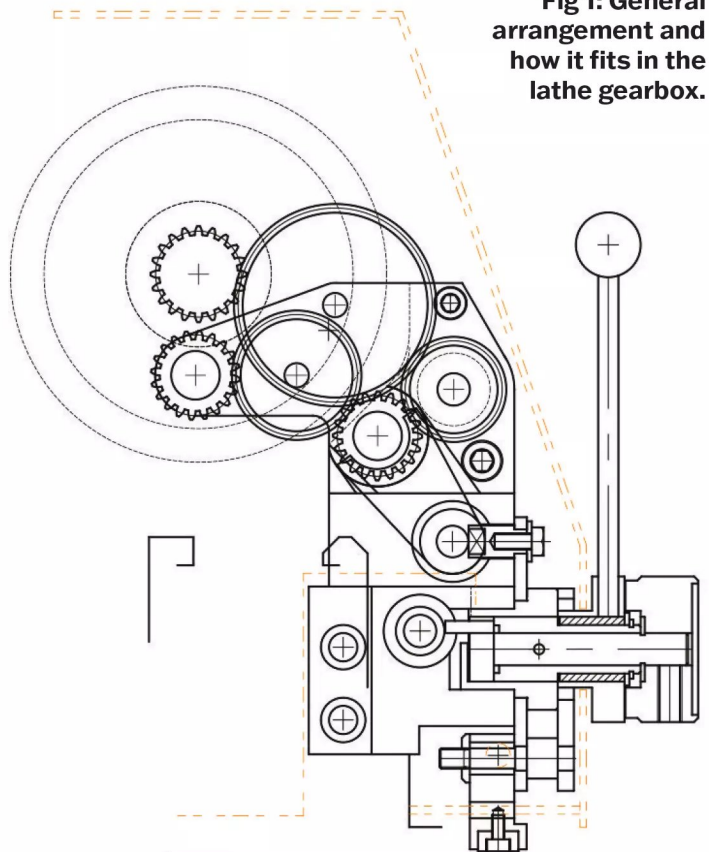


Render 2: Gearbox internal components.
(John Slater)

Fig 1: General arrangement and how it fits in the lathe gearbox.

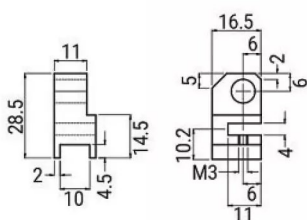


G.A. Front View

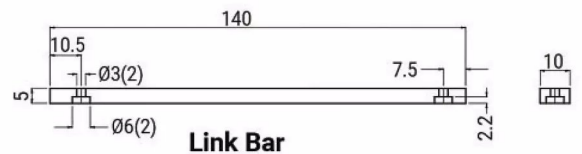


G.A. End View

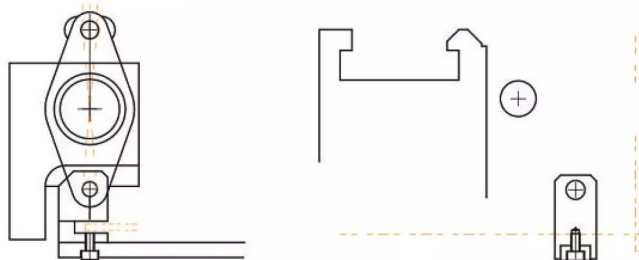
Fig 2: The link bar and related parts.



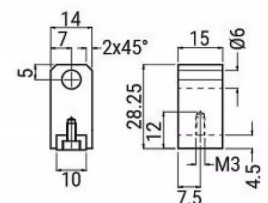
Fulcrum Link Block



Link Bar



Link Bar Assy & Parts



Trip Rod To Link Block



Photo 3: The gearbox, before modification. (Jamie Wood)

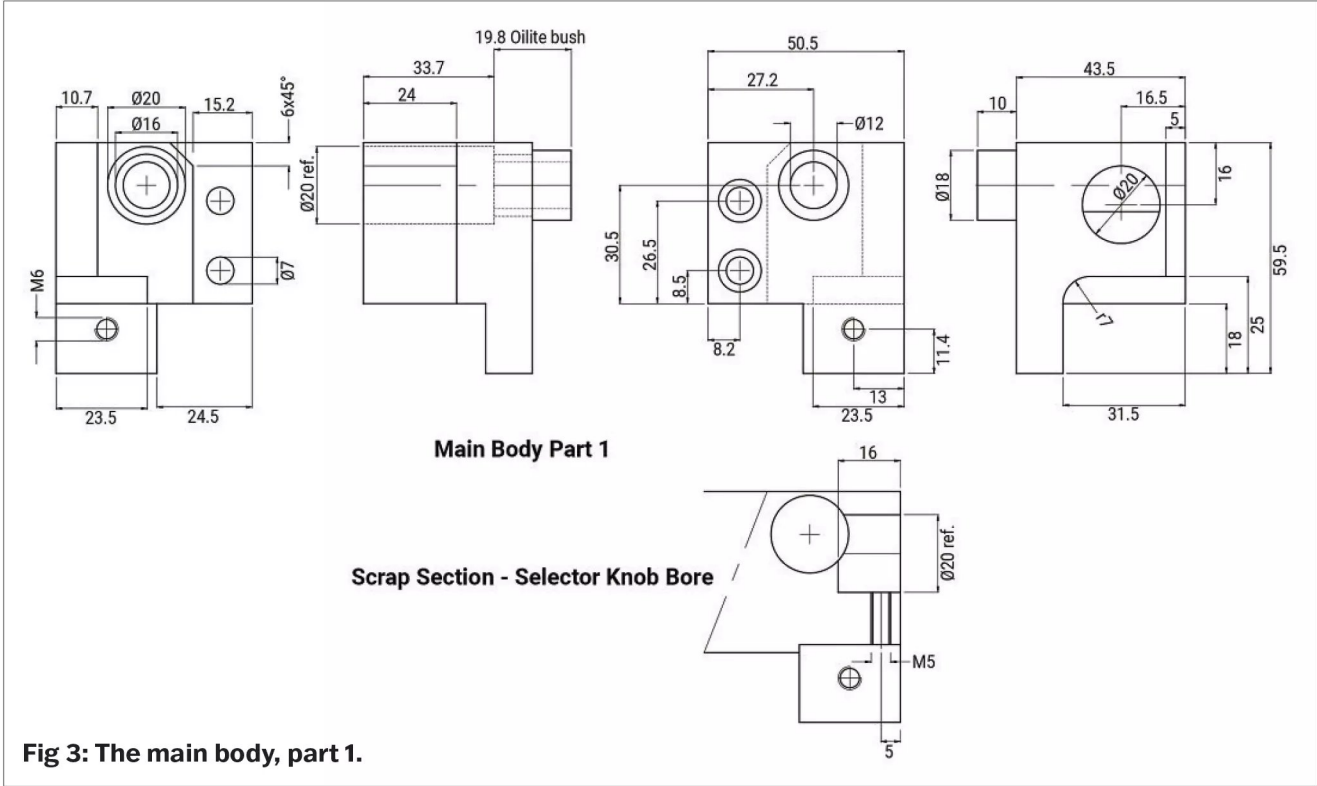
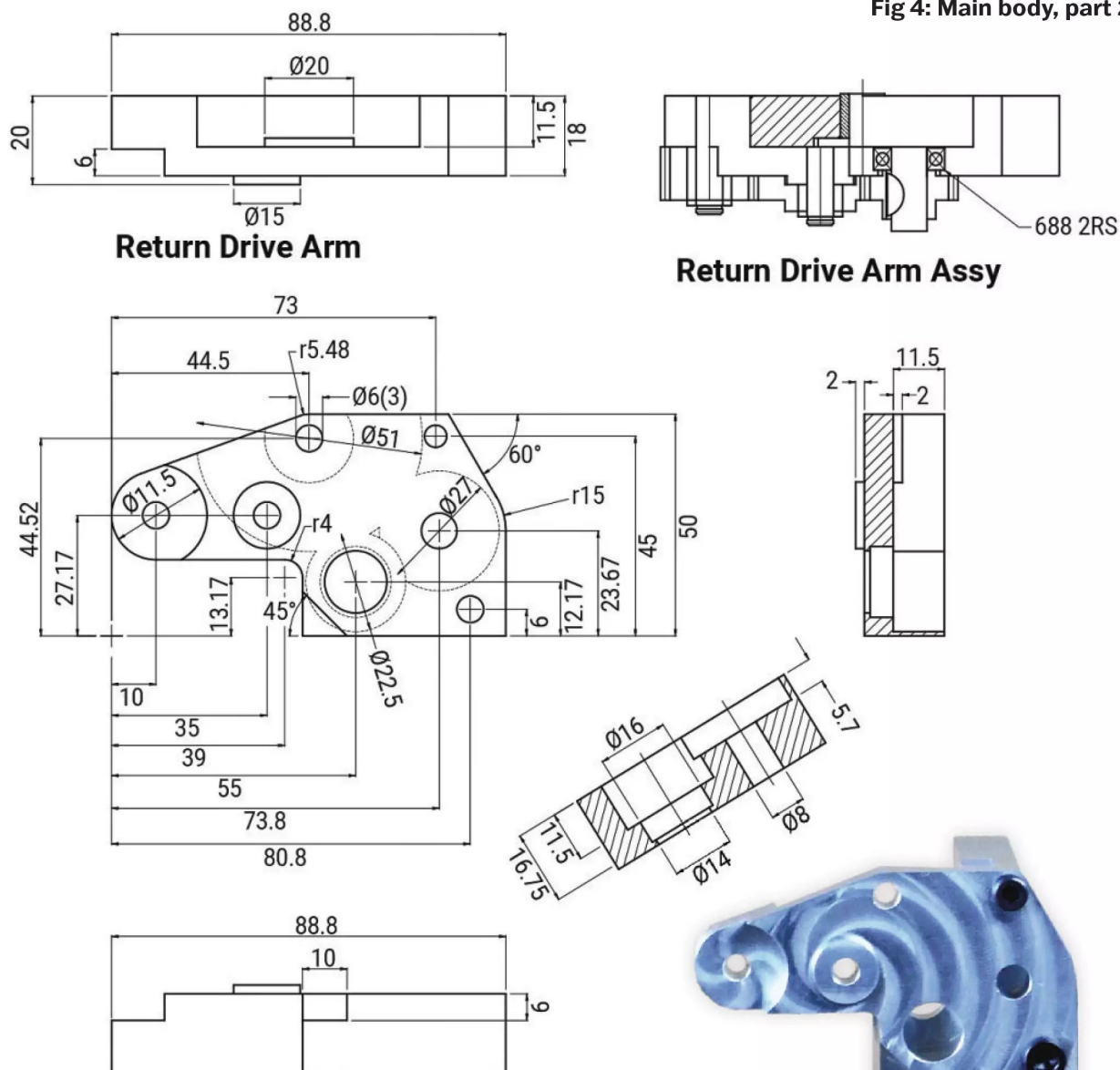


Fig 3: The main body, part 1.

Fig 4: Main body, part 2.



it comes to the main elements of a machine tool.

A modified Oilite bearing was used in the main body where the leadscrew input shaft runs. This is a standard 12mm bore by 18mm diameter, 20mm long bush. To preserve concentricity this is best mounted on a mandrel to turn down the 16mm diameter portion to press into the main body part 1.

Once the two-part main body hurdle had been overcome the project proceeded with only one more oversight on my part. At the design stage I had drawn out the complete package only to find that one of the original Emco TPI screwcutting gear trains was fouling the output idler gear which takes the drive from the dog clutch output shaft to the input gear

which replaces the mandrel gear. Using the power of AutoCad, moving things around was not too difficult and this problem was soon overcome ... or so I thought.

In my initial design, I had made provision for the mandrel Vee-belt to clear the dog clutch selector by a large margin when shifting to the largest pulley, i.e. slow speed. After moving the gears around I had inadvertently overlooked this feature of the design. This is why the dog clutch selector now has a cam lobe flank profile on the side. The problem then became how to see this lobe when fully assembled, as it is impossible to view this component. The operator therefore cannot tell where the lobe or flat is. Luckily, the keyway in the output gear was made in alignment

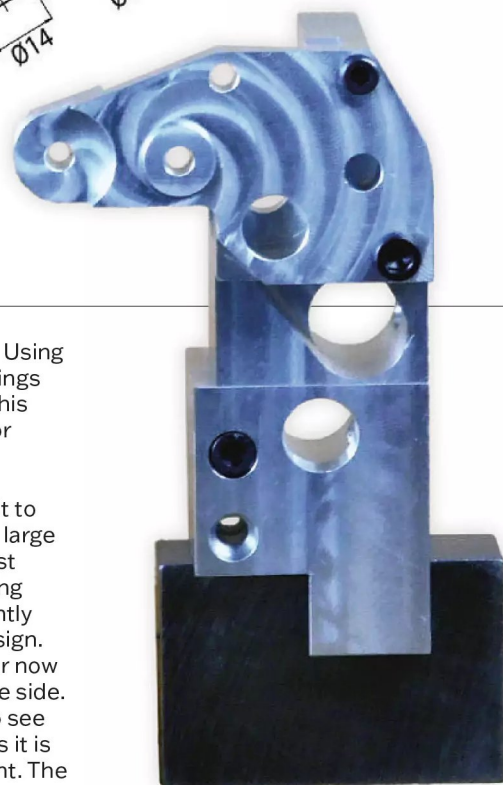
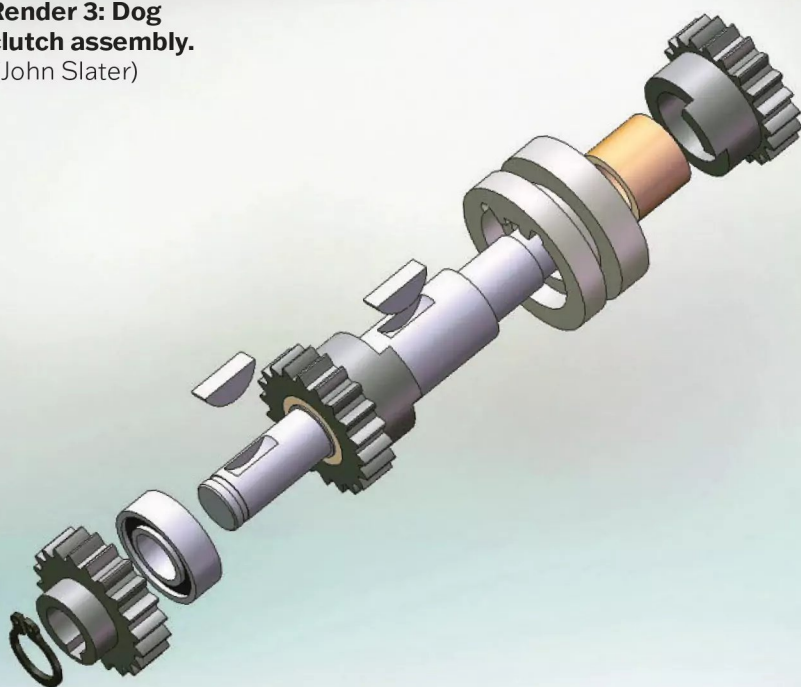


Photo 4: The main body, assembled from two pieces.

Render 3: Dog clutch assembly. (John Slater)



with the keyway in the dog clutch. This gives a tell-tale as to the position of the lobe externally which will allow the selection of the slow speed belt position. With the dog clutch lever in neutral and manually turning the external output gear to put the keyway at about the 5 o'clock position, this ensures the belt will clear the dog clutch selector.

The simple jig shown in the drawings makes short work of this feature and makes alignment of the lobe to keyway a certainty.

The dog clutch selector is now technically slightly out of balance; there is room to put a simple brass eccentric weight on the output gear boss to counteract this. This can be secured with a small grub screw and the eccentric mass is placed opposite the keyway. In use, however, any out of balance that there might be has not shown up during machining, given that this is running at mandrel RPM, either with regard to vibration at higher speeds or cyclic defects in the machined surface. Whether I shall ever get around to fitting this item remains to be seen. Currently it is not contained in the drawings.

To be continued.



Photo 5:
Another
view of the
main body.

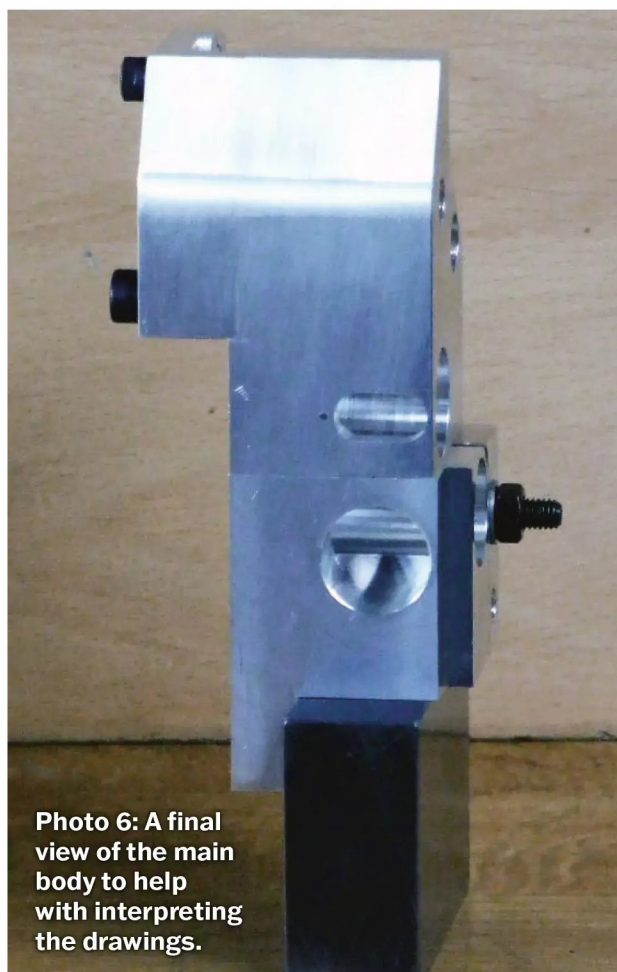


Photo 6: A final
view of the main
body to help
with interpreting
the drawings.



Gerald Martyn builds a locomotive he can lift. Continued from Model Engineer & Workshop issue 4763.

Photo 89:
The hangers and blocks.



A GWR Pannier Tank in 3 ½ Inch Gauge

PART 12
Brakes

Next to consider are the brakes. On Rob Roy and here also, these are optional and can be left off to save some time, but I needed to know where all the bits go so that I could design other parts around them. On the model they will only be used for parking, of course, not stopping the train. On the original only the driving and rear coupled wheels are braked, which reduces the parts count a bit, and the brake hangers are made from flat plate and so are ideal for laser cutting. The main problem to be overcome when designing the model is that on the full size engine the pull rods and load equalisation mechanism are directly under the ash pan which would prevent dropping the fire as we usually need to do after a run. I have therefore redesigned the pull rods to pass under the frame plates. This will be barely visible externally, whilst the bits we mostly see - the brake blocks and hangers - can be close to scale. I've simplified things too, and made all the flat parts except one suitable for laser cutting, saving hours of work. One simplification is that the (relocated) equaliser cross beams are fitted as a pair to ensure symmetrical pivot pin loading, without the complication of making fork ends, and the same type of beam is used as a spacer across at the driving wheel brake position, so reducing parts differences. More time saved and none of this really

shows externally. The brake system G/A is shown in **fig 34**. There are some places where clearances are rather tight. Firstly, the forward brake hangers are very close to the motion brackets and this limits how far the brakes can be wound 'off'. Actually, it may be no bad thing to have a positive 'off' stop as I've often wound my locomotive brakes far further away from the wheels than really necessary just to be sure they're not holding me back. Another notable close clearance is below the brake handle, at the pull link. Here a thin-headed pin is used to ensure clearance to the guard-iron rivets; the brake handle will restrict cab access for our sixteen-times too big hands so needs to be pushed as far to the side as possible. The brake blocks themselves are fairly close to the wheel flanges, as in full size, so be sure to put the radius on the inner edge of the blocks to ensure clearance to the flange radius. Finally, the brake hanger pins are designed to just clear the coupling rods even if these are not thinned on the inside face. There are lots of laser cut parts;

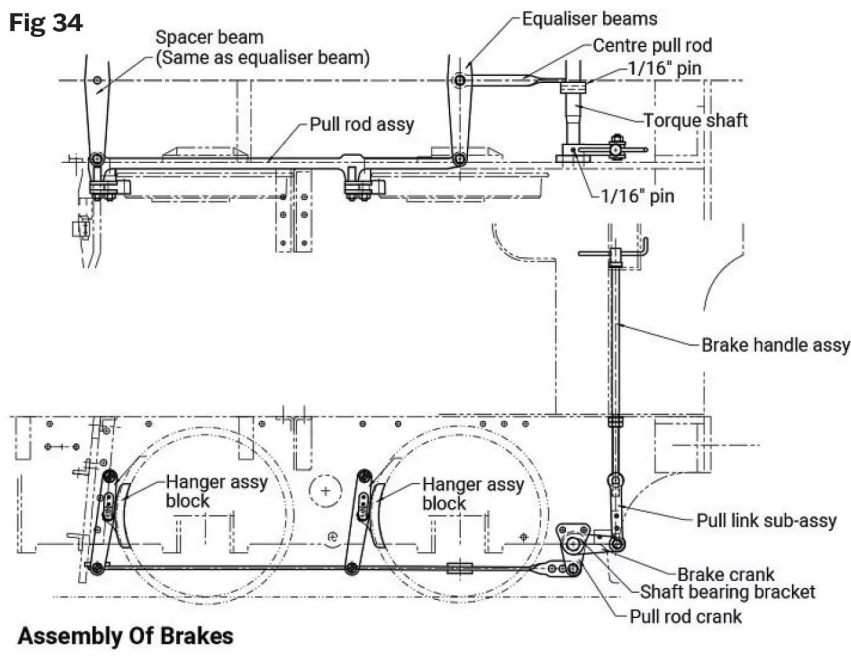
I'll not say much about the laser cut flat parts. Drawings for these, such as needed to complete them, are shown at

Title	M.E. Laser Part No.	Material	No. Required
Brake Blocks (Ring of 6)	29421	6mm Mild Steel	1
Brake Hanger	29422	1.5mm Mild Steel	8
Brake Pin Keeper	29423	0.9mm Mild Steel	4
Brake Pull Rod	29424	1.5mm Mild Steel	2
Brake Beam	29425	1.5mm Mild Steel	3
Brake Centre Pull Rod	29426	1.5mm Mild Steel	1
Brake Shaft Bearing	29427	3mm Mild Steel	2
Brake Crank	29428	5mm Mild Steel	1
Pull Rod Crank	29429	5mm Mild Steel	1
Brake Link	29430	1.2mm Mild Steel	2

fig 35. They will need cleaning-up and de-burring as usual, and holes reaming out (all pivots are 1/8" diameter). The pull rods need some pins silver-soldering in place; a simple enough job. Make them just a touch too long and file back to size after soldering. They are hollow to take bonded-in 8BA studs. There is no appreciable pull-out load here so this will be plenty strong enough and saves lots of time fiddling about cutting threads. If a black-oxide finish is to be done by heating then of course this needs to be done before any bonding. Twisting the centre pull rod is easy, just use an adjustable spanner, **photo 88**.

Drawings for the brake hanger assembly and the brake blocks are at **fig 36**. The brake block pins are made from 1/8" rivets and held in, as on the

Fig 34



Assembly Of Brakes

original, by little keeper clips which can be bent up from laser cut parts. Fix the clips with 3/64" rivets and, when done, this becomes a permanent joint so do remember to put the pins in first! The hangers now become handed so two right-hand, two left hand please! When assembled with the blocks, the pin simply goes through the rear hanger (and the rivet holes in it are redundant). The brake blocks themselves come as a ring of six so the flange and the taper can be turned in the lathe. This is slightly more expensive than four

single blocks, but saves on machining time. The hole positions will be laser marked and these must be drilled before turning the flanges to thickness. If, like me, you break a pilot drill doing this, then the piece with the drill in can be cut away and there's still a spare block for the next blunder. The ring is quite flexible so take light cuts. The hangers and blocks are shown in **photo 89** (I forgot to put the loose spacers in this shot) and in finished form in **photo 90** where you can just see the pull rod behind. Note that the

hanger upper pivots have 7BA threads whilst the pull rod pins have 8BA. This follows from the original G/A drawing which shows same size pins top and bottom of the hangers, but smaller nuts at bottom. I have to say, however, that in photographs the hanger upper pins appear to have collars and pins rather than nuts, though the picture are usually a bit too grainy to be sure.

The turned parts are shown in **fig 37**. Apart from at the brake hangers, the pivot pins are my usual composite design as described previously. They are mostly dimensioned to be just a little shorter than the parts they go through so that the joints can be closed up to eliminate any unnecessary side play. Brake parts tend to be a bit wobbly on their pins and this helps to keep it under control. The nuts can be locked in position with a spot of (you've guessed it) Loctite. The levers, torque shaft and bearings need little comment except to say that the shaft is smaller diameter at the ends than in the centre because that's the way the real one was. Pulling the brake on causes bending and this is greatest at the centre, so more metal is needed. They knew a thing or two at Swindon.

Finally, the brake handle assembly can be made but not fitted. I've not provisioned a stand for it and it will simply drop through the cab plate-work. The stand on the original is well hidden within the plate-work and the extra complication trying to do it like this is not, in my opinion, worth the effort.

Fig 35

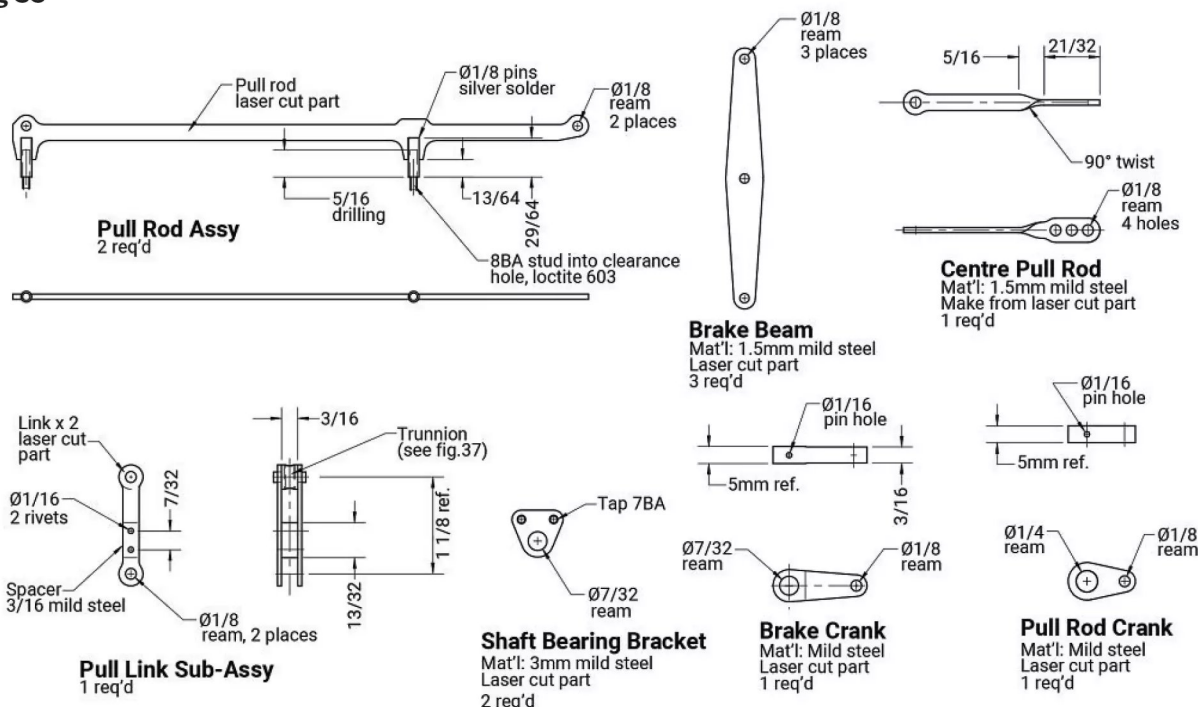




Photo 88: Twisting the centre pull rod.



Photo 90: Brakes fitted to coupled wheels

Fig 36

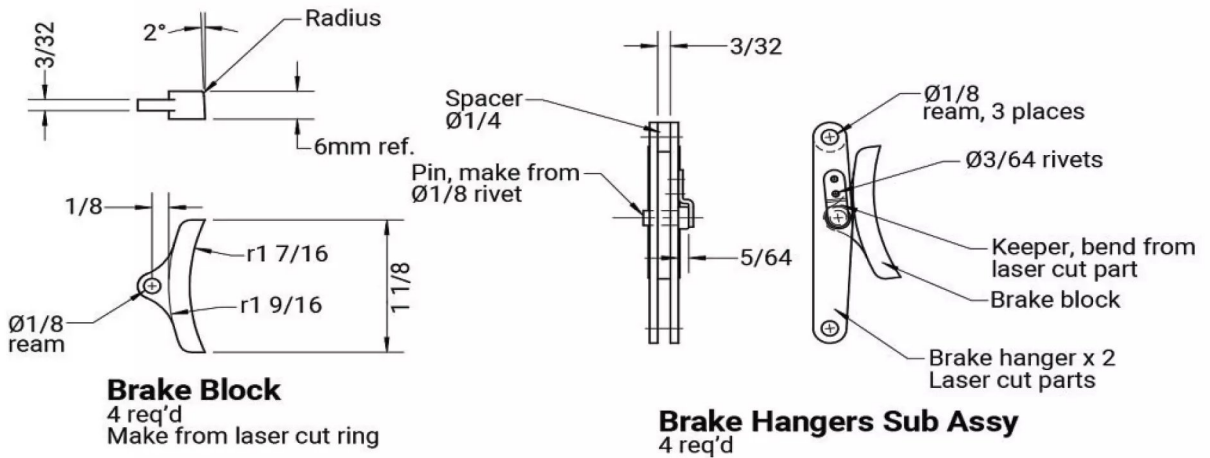
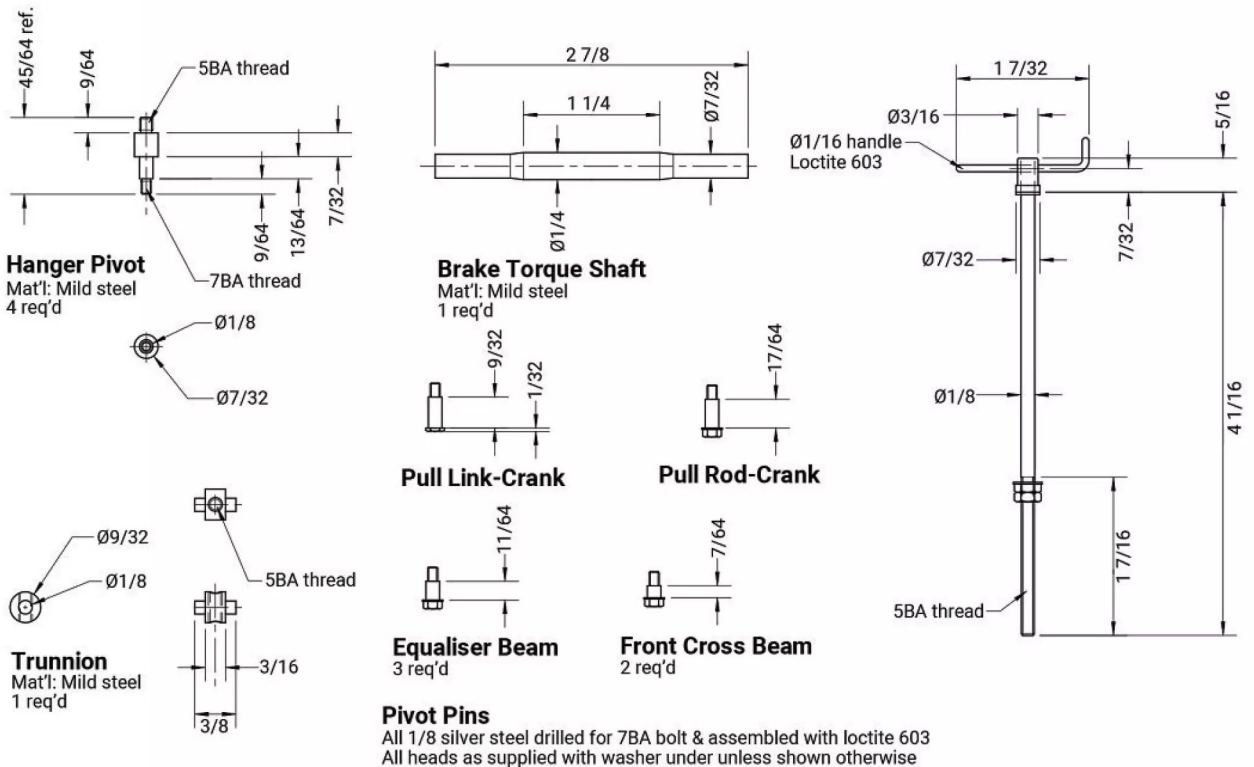


Fig 37



On the Wire

News from the world of engineering

Wideblue Showcases Space-tech Expertise in London



Product design consultancy, Wideblue, based in Glasgow, recently showcased an ambitious project to develop an optical communications system with very low size, weight and power for High Altitude Platform Systems (HAPS). HAPS are lightweight, unmanned aerial vehicles offering prolonged flight at altitudes into the stratosphere, see the photo of the SkyDragon HAP. They can be deployed quickly and provide persistent coverage over large areas. Applications include disaster relief, remote sensing/monitoring and providing telecommunication services to remote areas. Optical communications are key to enabling communications between the HAPS and other platforms/ground stations as the radio frequency

spectrum is becoming too crowded and bandwidth requirements are becoming ever higher.

The project uses the latest breakthroughs in micro-LED light sources and single photon detectors pioneered by the University of Strathclyde's Institute of Photonics over the past two decades.

Successful trials of the HAPS module have recently been completed on a tethered platforms to simulate real world environment.

Mark Sansom, Group Engineering Director at A2E/Wideblue said: "This has been a fantastic project to work on and has made full use of our skills in the areas of optics, photonics, mechanical design, electronics, FPGA and software design."



Autonomous Helicopter

Leonardo, the Royal Navy and the UK Ministry of Defence's Defence Equipment and Support Future Capability Innovation team have unveiled the design of the Proteus technology demonstrator aircraft. The circa three-tonne uncrewed rotorcraft will be used to demonstrate advances in autonomy and payload modularity and interchangeability, whilst developing cutting-edge new rotorcraft technologies including design and manufacturing techniques. Its development supports the Royal Navy's Maritime Aviation Transformation strategy, which covers the evolution of maritime aviation out to 2040. This includes building mass at sea and supporting future anti-submarine warfare missions.

The design of the Proteus technology demonstrator, images of which were published in January, reveals that it has drawn on components from throughout Leonardo's helicopter portfolio in order to reduce costs and accelerate aircraft development. Leonardo has also drawn on knowledge and experience from across its existing Uncrewed Air System programmes.

Leonardo is also experimenting with the application of new digital manufacturing technologies in rotorcraft production, including additive layer manufacturing (3D printing) and the use of cost-effective low temperature cure composite materials, which require fewer manufacturing stages in the production of parts. Once proven, these technologies will be employed more extensively to deliver agility through spiral development techniques, reduce through-life costs in comparison to conventional crewed aircraft, and improve manufacturing resilience and sustainability throughout Leonardo's supply chain.

Car safety tech driving motorists round the bend, Which? finds

Motorists are switching off automatic safety tech designed to help cars adhere to the speed limit, stay in the right lane or brake to avoid collisions because they find it dangerous, distracting or useless, according to new Which? research.

In a nationally representative survey of more than 1,500 drivers, more than half (54%) told the consumer champion they turned off at least one of the five main Advanced Driver-Assistance Systems (ADAS) features in their car at least some of the time. ADAS car safety tech is designed to assist drivers with safe operation, enhancing road safety and potentially preventing accidents through features like automatic emergency braking and adaptive cruise control. These safety systems have the potential to reduce avoidable accidents. The European Commission has cited figures that they could reduce injuries from crashes where a car leaves its lane by between 20%-30%.

But it can take just one incident for a driver to lose faith in the technology - and Which? has received hundreds of complaints from owners of different car brands about their vehicle's behaviour in the last year.

Which? found that speed assist, which can help drivers stick to the speed limit by alerting them if they go too fast or automatically limit the vehicle's speed, was switched off by nearly half (46%) of users some of the time.

Most people Which? surveyed said they had disabled this function because they felt they didn't need it. Depending on the system, speed assist uses on-board cameras, road-map data or a combination of both to issue a speed limit warning; however, it can be inaccurate if it picks up road signs for parallel roads, unofficial signs and digital signage.

Lane-keep assist was the second safety feature most likely to be disabled according to Which?'s survey (42%). Half of those who said they turned off lane-keep assist did so because they found it either dangerous, annoying or distracting. On-board cameras and sensors detect lane and road-edge markings and manoeuvre the driver into staying in their lane but this may be flawed while driving on narrow roads and can fail to account for cyclists or parked cars.

The third safety feature drivers were likely to switch off according to the

Which? survey was emergency braking (34%).

A third (32%) of the drivers Which? surveyed said they had turned off the attention or drowsiness monitoring feature. Cockpit cameras detect the position of the driver's eyes and can warn if it detects signs of tiredness such as yawning. The car can also detect if the driver's eyes are off the road too often - for example when operating the car's touch screen. Some ADAS systems are legally mandated on new cars in the EU and while the UK is yet to adopt the same rules, most UK cars use software designed to work both here and in the EU.

Harry Rose, Editor of Which? Magazine, said: "These features should be keeping motorists safe, so it is really concerning that so many people are turning them off because they don't find them useful, or even worse, that they find them distracting or dangerous. "It's up to legislators and standard-setters to make sure these features are fit for purpose and for the UK's roads, but if you are in the market for a new car, it's really worth going for a test drive to see how the car's safety features work in a real-world scenario."



Hidden environmental cost of steel corrosion threatens sustainability goals

Germany-based corrosion specialist Steelpaint is calling for urgent action to address the significant environmental impact of steel corrosion, warning that inadequate corrosion protection is contributing more to global CO2 emissions than the entire aviation industry.

With some industries consuming more than 100 million tonnes of steel annually, premature corrosion and subsequent steel renewal work is increasing carbon emissions dramatically, said Steelpaint's Managing Director Klaus Müller. "Addressing this issue through effective steel protection is

an economical and environmental imperative. Every premature steel asset failure triggers a replacement cycle that indirectly undermines the industry's decarbonization efforts." Steel production remains one of the most carbon-intensive industrial processes. To produce a single 10m by 10m, 20mm thick steel plate, for instance, emits about 3t of CO2. Factor in transportation costs and the need for additional coatings, and the carbon footprint looms large. This is underscored by joint research study carried out by Curtin University and Ohio State University and

published in 2022, which estimates that 25% of global steel production is lost to corrosion, with replacement and renewal accounting for 4 to 9% of total emissions globally.

Global demand for steel in 2024 was 1.8 billion tonnes and forecast to grow by 2.9% by 2030. The shipbuilding industry alone consumes 32.2 million tonnes per year, of which China, South Korea, and Japan use 88.3%.

Dmitry Gromilin, Steelpaint's Chief Technical Supervisor, said: "By extending the lifespan of steel structures with effective corrosion prevention technology we have the potential to reduce emissions further. But the link between steel protection and carbon emissions has so far been overlooked."

Readers' Tips



We have £30 in gift vouchers courtesy of engineering suppliers Chester Machine Tools for each month's 'Top Tip'. Email your workshop tips to meweditor@mortons.co.uk marking them 'Readers Tips', and you could be a winner. Try to keep your tip to no more than 400 words and a picture or drawing. Don't forget to include your address! Every month we'll choose a winner for the Tip of the Month and they will win **£30 in gift vouchers from Chester Machine Tools**. Visit www.chesterhobbystore.com to plan how to spend yours!

Quick And Easy Clamping Screw

This tip from John Barber is a short cut to making a good-looking clamping screw, he wins this month's Chester voucher.

I needed to make a new clamping screw for a small vice I was restoring. I began by removing the head from an M12 set-bolt, and loctiting on an M12 stud connector. The ends were faced flush on the lathe,

and the hexagonal surface turned down just enough to make it cylindrical. My first thought was to use two standard M12 nuts tightly locked together, but this could be risky because the cross-hole removes much of the core material. A single length of stud connector is much stronger. I cross-drilled 8.2mm, using the milling

machine to get the hole accurately centred. The tommy bar was made from 8mm silver steel (drill rod). Each end was turned down a little, then threaded M8 using a tailstock die holder. A standard M8 nut was fitted, the ends faced flush, and the hexagonal surface turned down to a cylinder.



Please note that the first prize of Chester Vouchers is **only available to UK readers**. You can make multiple entries, but we reserve the right not to award repeat prizes to the same person in order to encourage new entrants. All prizes are at the discretion of the Editor.



Ian Couchman reports on how his model threshing machine fared when used 'in the wild' at various live steam shows and describes a jig he made to join its leather belts.

A Leather Belt-Joining Jig for a Threshing Machine

My model Ransomes Threshing machine was featured in *Model Engineer* issues 4542 to 4562. It stood up well

in regular use for demonstrations and proved very reliable.

A couple of minor operational problems reared their ugly heads,

both related to straw and it getting to places that straw shouldn't be. This was aggravated by the shortage of wheat to thresh, meaning that the straw had to be recycled (many times). As a result, the straw was beaten into a fibrous mess, which has a tendency to mat together.

On, then, to the issues. Firstly, I found that the mouth of the upper shoe (where the grain, chaff and cavings drop down to the cavings riddle) was getting clogged with straw. It took a while to work out how the straw was getting there. The mystery was finally solved by running the machine with a piece of clear plastic in place of one of the top covers, letting me see how the straw travelled. It turns out that the straw was leaving the drum so fast that it was hitting check plates further down the machine and bouncing back, under the drum plate and onto the upper shoe, **photo 1**. On a full-size machine, this wouldn't happen. As straw travelling

Photo 1: How straw feeds into the machine.

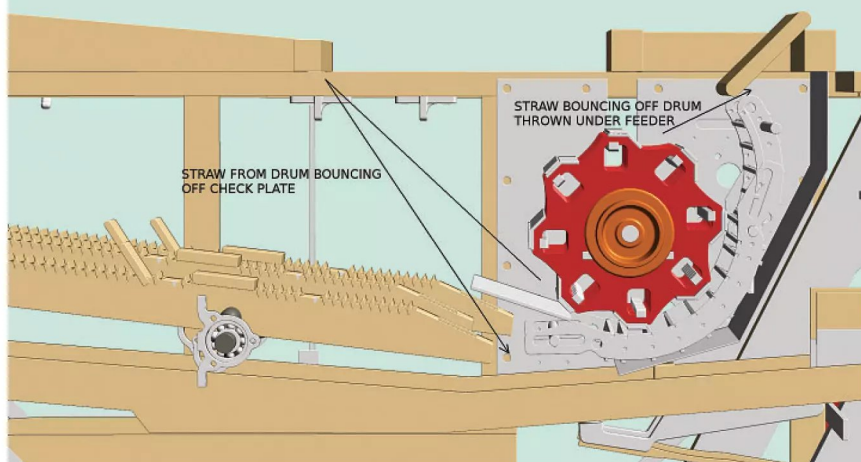


Photo 2:
Leather
belt
joining
jig.

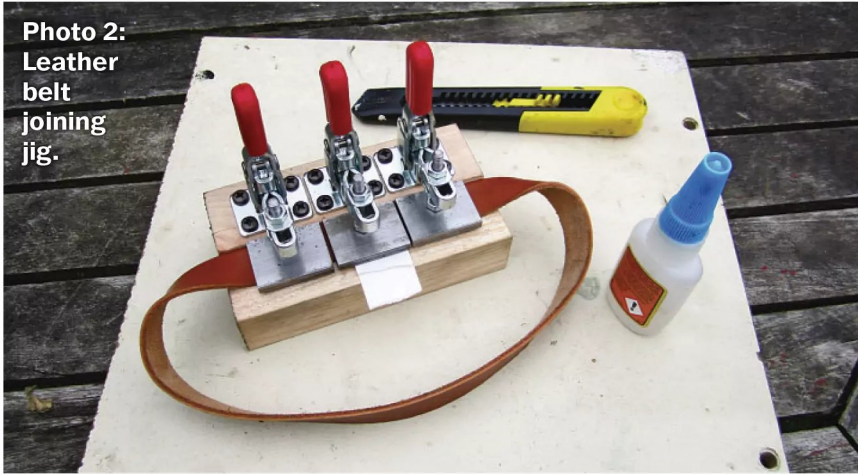


Photo 3: Belt cut in preparation for joining.



Photo 4: Align and
clamp first section.

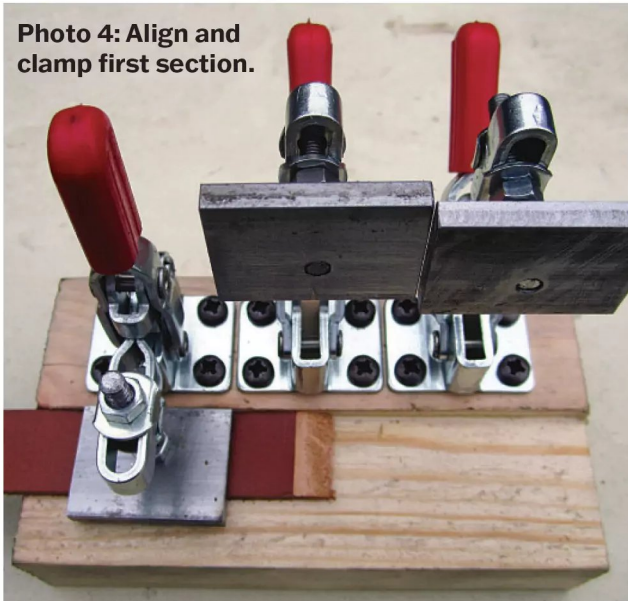
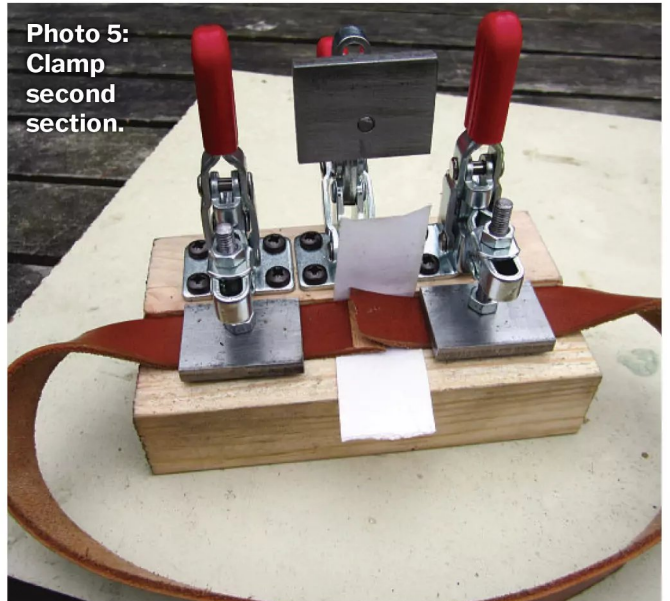


Photo 5:
Clamp
second
section.



sideways is not the most aerodynamic object, it will slow fairly quickly and, on the full-size machine, it will have four times the distance to travel to the check plates and four times the distance back to the end of the shakers. Reluctantly, I had to remove the rear check plates, which solved the problem.

The next problem was straw getting behind the concave, blocking the space between the concave and the back cover. This was found to be caused by straw bouncing off of the drum as it was fed in and travelling through the gap between the underside of the feeder and the top of the concave; see photo 1 again. Fitting a plate to block this gap reduced the problem (especially when using new straw) but I intend to alter the back cover to give a larger gap, preferably wider at the bottom to encourage any straw to drop out.

Worried about the consequences of a failed belt, I felt I would like to have the means to repair a belt out in the field. It could also be useful to shorten a stretched belt, since there's no adjustment on any belts and they do tend to stretch, especially when you forget to drop them off of the pulleys overnight (ask me how I know). I came up with the simple jig in **photo 2**. A piece of wood with a rebate cut in it to line up the belt sections, three over-centre clamps, a sharp knife and a tube of Superglue. The plates attached to the clamps were deliberately made with the fixing hole off-centre to allow the plates to be positioned centrally over the leather, regardless of width. In use, firstly the ends of the belt are cut at an angle, **photo 3**. The first end is then clamped in place, **photo 4**. Next, the second end is clamped in place, **photo 5**; note the piece of silicon paper underneath the

Photo 6:
Making the
joint.

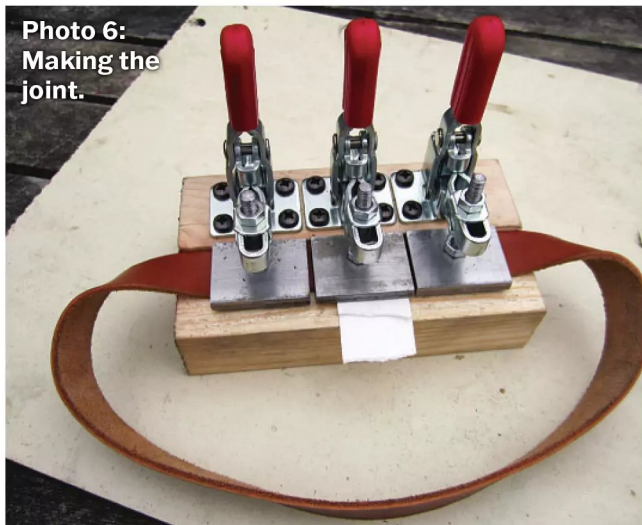


Photo 7: Finished belt.

join to prevent the belt sticking to the jig. Then one end of the belt is lifted, Superglue is spread thinly over one side of the join and the join is clamped, **photo 6**. After a minute or two, the belt can be removed, **photo 7**, and threshing can continue!

A final thought: I have often complained that no one is growing scale wheat. It turns out that everyone is growing scale wheat! While researching

crops on which the threshing machines were used, it dawned on me that wheat grown in the heyday of the threshing drum was a lot taller than modern crops. Thatchers wouldn't accept straw less than three feet. Most of the crop would have been about four feet high but modern varieties have been developed with shorter stems as the taller wheat couldn't carry the greater ear size and weight. I was cutting the crop down

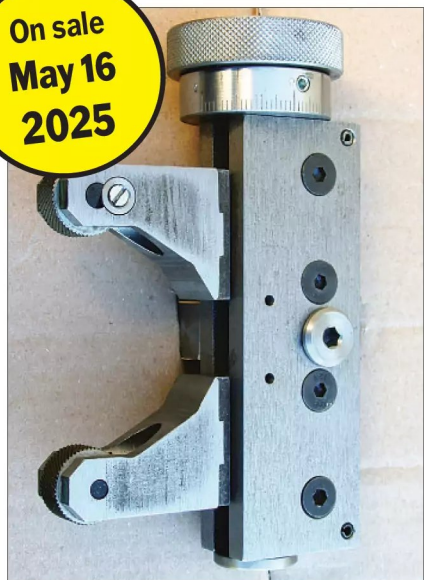
to about 4-5 inches, something less than half the width of the drum. Since the full-size drum would have been 54 inches, four-foot wheat would have been about 85% of the drum width, meaning that my wheat needs to be about 10-11 inches long. It turns out that this length works well.

I've got the traction engine and I've got the threshing drum so I'm all set for a new career as a threshing contractor!

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Setting Up a Variable Speed Motor Drive

For many years the IMO Jaguar Cub has been a favourite inverter drive for small workshops, but it's been replaced. **Joe Jordan** of TRANSWAVE Converters introduces its successor.

Long time readers of this magazine may remember an article I wrote regarding connecting a variable speed drive unit to a lathe to give it the flexibility of variable speed. That was in 2018 and a lot has changed since then...

The Jaguar CUB model featured at the time was so good that IMO stopped making it (like those brilliant Topic chocolate bars). It has been replaced by the exceptionally good, if less catchily named, SD1 Inverter drive ... although sadly no replacement has been offered for Topic. If you've never experienced using your machine with a variable speed drive as opposed to the traditional belts and pulleys, or gears, then you're in for a treat. Contrary to popular belief, the machine really shines when the variable speed drive is used in conjunction with (and not instead of) the existing speed change mechanisms

– thereby offering an even wider range of speeds than either method alone. This drastically improves usability, flexibility and even saleability if you decide to part with the machine down the line. It also allows for a 3-phase machine to be powered using an ordinary 3-pin single-phase plug!

The inverters can be supplied on their own or as part of a package, **photo 1**, including:

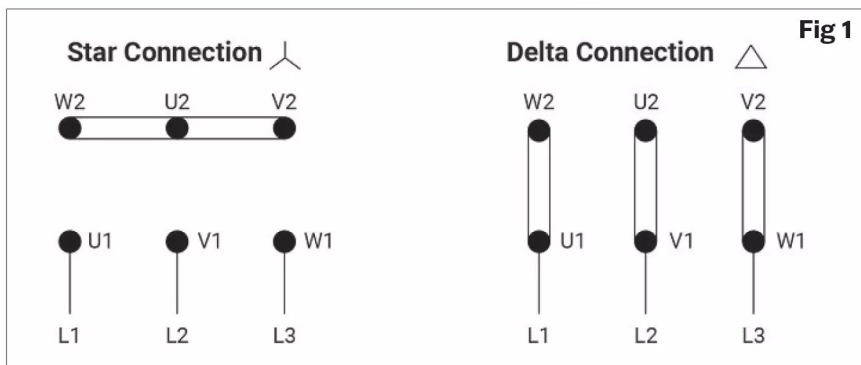
- SD1 Inverter Variable Speed Drive
- 3 Phase Electric Motor
- Remote Control Station (RCS)
- Screened cable to go between motor and inverter

Your existing motor may be already compatible with a variable speed drive. The motor needs to be dual-voltage, essentially able to be powered from 240V three phase. If it is, the motor plate will indicate two different voltages.

If it isn't dual voltage, then you will need a new motor.

If you've ever ordered a pair of jeans online, then you'll know that sizing is crucial to getting the most out of the product. We offer motors in a range of sizes so we can cross reference our motor dimensions to the space left by your old motor to ensure as snug a fit as possible. Your old motor can then be repurposed if desired and has a range of uses including as a rather fetching doorstop.

Once your new motor control package arrives you may understandably feel intimidated. The package does not arrive pre-wired or programmed but rest assured the whole process is 'easier than Sunday morning' so you should be up and proverbially 'dancing on the ceiling' in no time. No prizes for guessing who is on the radio as I write this. What a feeling.



GETTING STARTED

The first step is to ensure that the motor terminals have been reconfigured. Regardless of which motor you chose, your new motor will be a dual voltage 3-phase motor wired for 415 Volts, however the inverter outputs 240 Volts so to get around this we need to change the wiring connections from 'Star 415V' to 'Delta 240V'. This sounds more complicated than it actually is, like an air fryer or the economy.

Simply unscrew the terminal block and you'll see six terminals with metal 'bridges' connecting the top three. Undo the nut on each and remove each metal link, then rearrange them to go straight down to the terminal below them, **fig. 1**.

The motor is now ready for connection to a 240V supply. If your existing motor is dual voltage then these steps will still need to be completed before connection to the inverter.

It's not the end of the world if you forget this step but when running, your motor will have no torque as a result of only being given half the voltage it requires.

Before popping the cover back on you now need to connect the 4-core screened cable to the motor terminals U1, V1 and W1. The motor includes an earth terminal to connect to, but the exact placement of this differs from motor to motor. It's all looking good so far!

CONNECTING THE INVERTER

In order to get the motor to actually do something it will need to be connected to the inverter drive. This is the brains of the outfit and is what does all the fancy science, maths and waveform chopping which I'm sure you understand fully and don't need me to explain. (Phew.)

You'll notice that the SD1 itself, like many drives, is 'open' at the top to allow for airflow and cooling, however this also means that dust and swarf will do its absolute best to get in there and ruin the party. As such, we strongly recommend that the inverter is placed out of harm's way in a cool, dry place but still be accessible for programming and adjusting any settings as necessary – although in our experience, once you have the inverter set up you shouldn't need to touch it again, with most of the

workload being handled by the remote control.

Once you have decided on a suitable place for the inverter to live then it's time to get the cables connected. You will need the other end of the motor cable that we connected earlier, and a length of twin-and-earth cable with an ordinary 3-pin plug (13A) on the other end.

Then, connect these cables to the inverter as follows:

- Connect the wires from the motor to U, V, W and G (earth) coinciding with placement on the motor terminals (e.g. U goes to U and so on)
- Connect the wires from the single-phase supply cable Live, Neutral and Earth to L (Live), N (Neutral) and Earth/Ground(G)
- ENSURE NO CONNECTIONS ARE MADE TO THE TERMINALS MARKED 'PB' and '+'. THESE TERMINALS ARE FOR BRAKING RESISTOR CONNECTION ONLY AND WILL CAUSE MAJOR DAMAGE TO THE DRIVE
- Seriously...

And make sure all covers are replaced before connecting to the power socket.

TESTING AND MOTOR SETUP

Now that the inverter has a motor and power cable connected, we can start the exciting part – getting the motor turning! There's a small amount of programming needed but it is no more complicated than 'press this, then press that', so just follow along and it should all work out.

The settings are all hidden within the menus organised into folders. All the folders have names that are easy to remember, like 'P01' and (my favourite) 'P00'...

Pressing the PRG/ESC key on the inverter accesses the menus and pressing DATA/ENT 'goes in to' that particular

menu. The up and down buttons allow navigation to different menus.

For example, pressing **PRG/ESC** will show 'P00' on the screen. Pressing **w** will then go into the 'P00' menu folder, and the screen will then show 'P00.01', the first option within the 'P00' menus. Once you understand this approach it becomes quite simple to navigate the settings and make changes. **PRG/ESC** then acts as a 'back' button to go back to the previous level within the menus.

With this mind, check/change the following settings:

• **Parameter P00.01** – Sets the control method of the drive. Factory Default is 0 which allows for control via the keypad and potentiometer on the drive (see P:00.06 below). If the drive does not respond to start/stop and potentiometer control, check that this value is set to 0.

• **Parameter P00.03** – Sets the maximum output frequency of the drive (acceleration and deceleration times are based on this value). Factory Default is 50Hz. You can change this parameter to any level between 0Hz and 200Hz. Note: (a) most motors are designed to operate at a maximum of 60Hz; (b) if this parameter is changed to more than 50Hz parameters P0.04 and P0.05 will need to be changed accordingly.

• **Parameter P00.04** – Sets maximum running frequency of the drive. Factory Default is 50Hz.

• **Parameter P00.05** – Limits the minimum running frequency of the drive. Factory Default is 0Hz. Note that minimum Frequency/Speed functions when motor is running. Display will not show minimum level set-point unless motor is running.

• **Parameter P00.06** – Allows use of potentiometer on keypad. Set to 1 if potentiometer required. Factory default is 2.

NOTE : P00.03 >= P00.04 >= P00.05 FOR DRIVE TO OPERATE CORRECTLY

• **Parameter P00.11** – Sets acceleration time of the drive from 0Hz to maximum frequency (set in P0.03). Factory Default is 10 seconds.

• **Parameter P00.12** – Sets deceleration time of the drive from maximum frequency (set in P0.03) to 0Hz. Factory Default is 10 seconds.

• **Parameter P00.13** – Sets the default running direction of the drive. Factory Default is 0. Change to 1 to reverse the motor direction instead of changing motor wiring.

• **Parameter P01.01** – Ensures Minimum Frequency level functions correctly. Factory Default is 0.5Hz. This should be set at 0.0Hz (see P:00.05)

• **Parameter P02.01** – This is where you input the kW rating of the motor.

• **Parameter P02.05** – This is where



Photo 1: The main components in the inverter, motor, pendant package.

you input the full load current of the motor at 220-240V (usually the higher of the two current ratings on the motor plate).

The last two items are particularly important for making sure the motor runs as expected.

Once these changes have been made, press the START button on the inverter and marvel at the rotational power you have created! The motor will run at its full rated speed when running at 50HZ. You can increase the max frequency to 60HZ to get a 20% speed boost without any issues, although we don't really recommend going higher than that.

You could stop there and use your machine as it is, however, it won't have escaped your notice that the inverter controls are small, fiddly and not ideal for frequent use.

This is where the Remote Control Station (RCS) comes in handy. The remote has a 7-core cable that we need to connect, and some set-up on the inverter to do, so let's sort that now.

Connecting the Remote Control

To get the inverter running using the remote control, we of course need to connect it. Before connecting the cables though we need to do some programming to essentially tell the inverter that we will be using the remote to operate it.

- Test the drive operation using the keypad
- Stop the drive
- Turn off the power and wait for the display to go blank
- Now connect the seven pendant wires and earth screen as shown in **photo 2** and **table 1**
- Turn on the power
- Press **PRG/ESC**
- P00 will be displayed
- Press **DATA/ENT**
- Press **UP/DOWN** arrow buttons until P00.01 is displayed
- Press **DATA/ENT**
- Default setting is 0. Press **UP/DOWN** arrow buttons until 01 is displayed
- Press **DATA/ENT**. The display will change to P00.03



Photo 2: Remote/Inverter Terminal Connections.

Wire Colour	Terminal Designation	Function
BROWN	COM (same as Green Cable)	Power
WHITE	S1	Forward
GREY	S2	Reverse
PINK	+24V	Power
BLUE	10V	Potentiometer (High Side)
YELLOW	A12	Potentiometer (Centre)
GREEN	COM (same as Brown Cable)	Potentiometer (Low Side)
Green/Yellow	Ground (Share with Power or Motor)	Earth

Table 1:

- Press **UP/DOWN** arrow buttons until P00.06 is displayed
- Press **DATA/ENT**
- Default setting is 0. Press **UP/DOWN** arrow buttons until 01 is displayed
- Press **DATA/ENT**. The display will change to P00.07
- Press **UP/DOWN** arrow buttons until P00.09 is displayed
- Press **DATA/ENT**
- Default setting is 0. Press **UP/DOWN** arrow buttons until 1 is displayed
- Press **DATA/ENT**. The display will change to P00.10
- Press **PRG/ESC**. The display will show P00
- Press **UP/DOWN** arrow buttons until P05 is displayed
- Press **DATA/ENT**
- Press **UP/DOWN** arrow buttons until P05.01 is displayed
- Press **DATA/ENT**
- Press **UP/DOWN** arrow buttons until 01 is displayed
- Press **DATA/ENT**. The display will change to P05.02
- Press **DATA/ENT**
- Press **UP/DOWN** arrow buttons until 02 is displayed
- Press **DATA/ENT**. Display will change to P05.03
- Press **PRG/ESC** twice – the display is now in 'running' mode
- Press the **START** button on the RCS pendant – the motor should now run as expected!
- The keypad directly on the inverter will no longer function apart from changing parameters. The remote can now be used to start, stop, speed up, slow down, change direction, run, jog and make tea!
- Actually, it can't make tea. Off you go then.

Note – Should you need to incorporate a guard switch/limit switch so that the unit will not run unless this is closed then remove the pink wire from the +24V terminal and connect to one side of the switch, then from the other side connect the switch to terminal +24V. Doodle.

TWEAKING AND FACTORY RESET

Run through all of those settings above to get the inverter just how you like it and then have a play around with it. Test it out and tweak as necessary. Of course, things might not always go to plan. Sometimes you'll change a setting, and the inverter will act different from how you expect, and you'll perhaps struggle to get it back to how it was before. If only there was a way to restore the factory default settings... (there is).

Restoring the factory settings is so straightforward that even a baby (with a background in electrical and/or mechanical engineering) could do it. It simply involves using the keypad on the inverter. Such is the nature of a factory reset, however, that afterwards you'll need to input the settings for the motor, acceleration time, frequency etc. again.

- Disconnect the PINK remote control cable from the inverter
- Turn on the power to the drive without running the motor.
- Press **PRG/ESC**
- Move the up/down arrow buttons until 'P00' is displayed
- Press **DATA/ENT**
- Move the up/down arrow buttons until 'P00.18' is displayed
- Press **DATA/ENT** (display shows 0)
- Press the up button until the display shows '1'
- Press **DATA/ENT** (This confirms the factory reset)
- Press PRG/ESC to get back to the menu display
- The inverter will now function as it originally did when you first removed it from the packaging.

And that's it, you've done it! Your new inverter package is all up and running with minimal explosions.

Of course, as with any electrical work, please ensure you take all relevant precautions and only undertake work if you are competent to do so. ●

Quick Notes from the Workshop

Punches, scribes and nail punches. What's the point?

Most readers will have noticed that sets of centre punches usually come in threes; why is this? Look closely at **photo 1**, and you'll see they have slightly different tips. The left-hand punch has a fine tip and is called a prick punch, used for making an accurate initial mark. The tip is usually ground at 60°, so only a light tap is enough to make an impression. If you have two crossed lines scribed on a piece of work, the prick punch will click into place at their intersection so you can place it accurately, easily and quickly. The middle dot punch has a stouter tip at 90° and is used with greater force to make a bigger mark. If required, follow up with the third punch which has a roughly 118° tip. This matches a typical twist drill and helps ensure a good accurate start for smaller drills, as it can stop them wandering.

Obviously, don't confuse punches with scribes, **photo 2**, these are longer and more lightly built, with a sharp 60° point on the very tip. Note that the far scribe has a tiny carbide insert. The other has a reversible point, held in a collet.

Photograph 3 shows a set of nail punches. Resembling centre punches, these have hollow points and are used for tapping small pins and nails below the surface of timber. The reason for including them here is that they can also be used as rivet sets – that is for forming heads on miniature rivets.

The model diesel loco in **photo 4** has a very large number of 1/32 inch copper rivets; these are very easy to close neatly, with just a few light taps from a rivet set. For these one of the hollow ended nail punches was used. Typically, to form a good rivet you will need just over one diameter of the rivet shank showing above the material to be joined. In practice, it may take you a few trials to work out the optimum length of rivet to give you a neat head. Support the 'neat' end of the rivet in depressions drilled in various places on a long steel bar held in bench vice as an 'anvil'. This can be used in different orientations to support riveting inside and outside the work. It's best to try to use the original rivet heads outside the body-work, although it isn't hard to make a neat closure with small copper rivets.



Photo 1: A set of punches.



Photo 2: Two very differently made scribes.



Photo 3: Nail punches that can serve as miniature rivet sets.

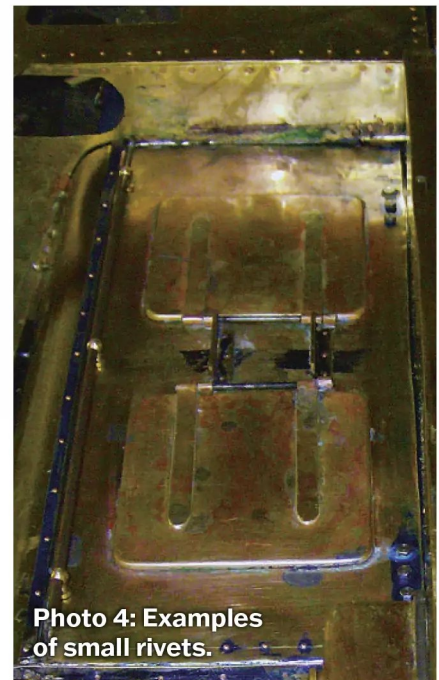


Photo 4: Examples of small rivets.

Photo 2: Preparing an LMS Pacific for work on the Midsomer Norton line.

The Midlands Garden Rail Show 2025

John Arrowsmith reports on the show for a hobby that 'fills the gap' between table-top railways and the passenger hauling gauges.

The Midlands Garden Rail Show 2025 opened at the Warwickshire Event Centre on Saturday 1 March (Dydd Gŵyl Dewi, Ed.) with a lovely bright, early spring day to greet visitors. The traditional arrangement of layout and trade stands was soon buzzing to the sounds and smells of the feature of the show, garden railway systems, along with the chatter of the many visitors. There was a diverse range of layouts in various gauges, along with many trade stands offering a vast array of products which I am sure satisfied those looking to buy. The now usual food and drink outlets were soon working hard, providing for the needs of the inner man with a good selection of products.

On to the main show presentations; there were some old favourites in action almost immediately so visitors always had something moving to watch, either steam operated or electric, along with some new layouts

which also caught the eye. The large **Midsomer Norton Gauge 1 layout** always provides an interesting variety of motive power and rolling stock which I think just about covers every railway company that could ever have run through this Somerset and Dorset

Joint Railway station. There was always plenty of activity and I liked the large BR 9F running at speed with a full rake of coal filled Windcutter wagons, **photo 1**. The motive power here covers the usual range, be it steam - both coal and meths fuelled - as well as battery



Photo 3: An overall view of the Halesfield layout which represents 12 months' work.



Photo 1: Bob Whitfield keeps a close eye on his 9F as it hauls a rake of Windcutter wagons round the Midsomer Norton track.

power and this gives the operators a great diversity of traction options. All the models here were first class in their presentation, as were the operators with some in their working clothes and others in their Sunday best - but it all made a great sight which kept the spectators happy. Visitors also had an opportunity to view different aspects of preparing these fine models for operation, **photo 2** and the 'crews' were always happy to converse with the audience about their models.

A new end-to-end layout in O-gauge was provided by the Telford O-gauge Group with an excellent, all action layout named **Halesfield Traction Maintenance Depot**. This is a fictional layout with an interchange goods depot one end and a diesel/electric maintenance depot the other end. This provides the opportunity to have both steam and modern motive power operating on the same layout. The remarkable thing about this layout is that twelve months ago neither the group nor the layout existed! The group was formed in February 2024 and the layout has been a tremendous achievement. It was full of detail which clearly showed the way the railways have changed over the years, from the steam era goods yard, to the modern TMD. Here again, there was plenty of movement and the brightly lit workshops provided a glimpse into present day working conditions. All in all an extensive and well-presented display, **photo 3**.

In complete contrast to the previous layout, the **Gauge 1 Vintage Tinplate Trains Group** had their large, old style track layout in operation which served to demonstrate how amateur modelling of railways has changed out of all recognition over the years. The quite heavy-duty track and short curves are in stark contrast to the fine

Photo 4: The unique 0-6-6-0 Gauge 2 locomotive at work on the Vintage trains display.



scale models of today. Nevertheless it is always good to see these veteran trains in action and they do go well, skimming round the circuits with consummate ease. The other interesting aspect of this layout was the provision of a circuit of track dedicated to the older Gauge 2 locomotives and rolling stock. A rare model of an 0-6-6-0 tank locomotive - which looked like it was based on the GNR condensing tanks and is purported to have been built by Henry Greenly himself - was performing very well, hauling a rake of wagons most of the day, **photo 4**.

There were two model engineering clubs present at the show, both displaying a wide range of garden railway activities. **Coventry MES** displayed a small oval of track to demonstrate a selection of locomotives and rolling stock which included an industrial engine and a rake of simple sand hopper wagons. Two scratch-built Gauge 1 locomotives stood out on their stand, one being a very nice example of a GWR Mogul 2-6-0 finished in unlined green, **photo 5**, together with an unfinished 0-4-2 engine which displayed some excellent workmanship. I was told it is to be coal

fired but I am not sure of the prototype; it could be the basis of a Darjeeling B class, **photo 6**.

The other model engineering club stand was provided by the **Bromsgrove Society of Model Engineers** who again had a wide range of garden railway locomotives and rolling stock on display. The experimental LNER 4-6-2 locomotive was an excellent example, in model form, of this large prototype and looked to be a real powerhouse **photo 7**. The Society also showed off a working 3D printing machine which was busily demonstrating the operations to build rolling stock for garden railways. A good selection of completed work was on display and visitors were invited to inspect and touch the printed results. The club member using the machine seemed to be busy answering endless questions from the visitors, **photo 8**. There was also a reference to Harry Potter with a special platform sign on display.

Another regular exhibitor at this show is the **Gauge 3 Society** who displayed an extensive range of models designed to run on the popular 2½" gauge 'garden railway' track. The locomotives can be live steam or electric with optional radio control and

Photo 5: A well-made GWR Mogul on the Coventry MES display.





Photo 7: A fine Gauge 1 model of the LNER Hush 4-6-2 locomotive.



Photo 6: Under construction was this coal fired 0-4-2 on the Coventry MES display.

the separate **Chalfont** layout showed exactly what can be achieved with these slightly larger models. A useful information board clearly described the differences in size and gauge between all the popular table-top railways, from 2½" gauge down to N-gauge, **photo 9**. The Gauge 3 Society layout, as mentioned above, is called Chalfont and it depicts a small GWR branch line station and goods yard, which gives good scope to include different types of workings. The local dairy has its own siding - as was so typical - and with all the detailed scenic work it comes together to provide a glimpse of times past in a rural setting, **photo 10**.

Newchapel Junction Railway is a regular at the show and this large fine



Photo 8: A member of the Bromsgrove club explaining the working 3D printer and what it can produce.

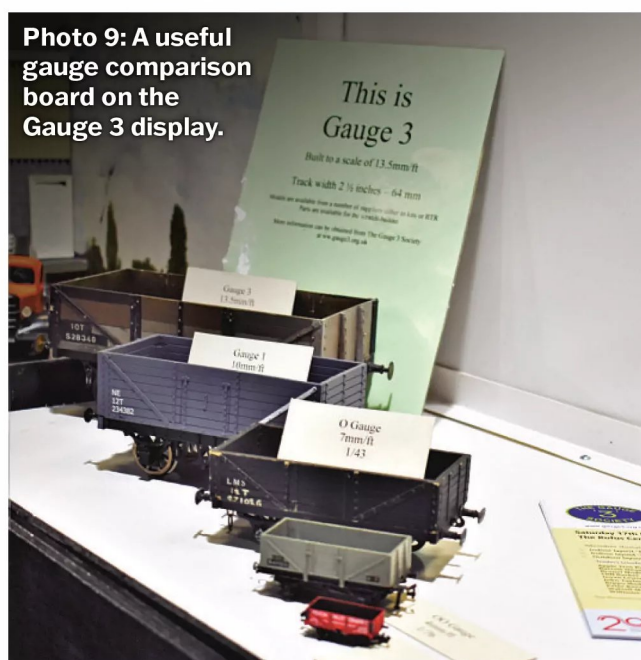


Photo 9: A useful gauge comparison board on the Gauge 3 display.

Photo 10: A station scene on the Chalfont display.



scale O-gauge layout stands out for its outstanding presentation and the precise actions of its various workings. The layout has two main control desks which incorporate traditional style bell codes for train operations. It is great to stand adjacent to the signalmen and listen to the bell codes *tinging* out as the railway works. It represents a post grouping period where both the GWR and the Southern railway ran together, so there are some interesting workings such as the GWR Mogul shunting Southern carriages, along with a large variety of motive power. Fully signalled, it operates as a railway should with scale speeds for all train movements, **photo 11.**

Lewiston is a G-scale layout which has not been seen for a few years but here it was, operating very well. The terminus station has a lot of detailed features and is well populated with scale figures which add to the overall atmosphere of a working railway, **photo 12.** Following on from Lewiston the **G Scale Society** publicity layout was another colourful and busy scene featuring numerous different aspects of the railway. There is always something moving on this layout which makes for an easy way to pass a lot of time, **photo 13.**

The National 2½" Gauge Association had their usual lavish display with a wide range of locomotives and rolling stock. One locomotive in particular stood out and that was a model built by LBSC himself, Ayesha.

Photo 11: One of the two control panels on the Newchapel Junction display.



Photo 12: This colourful 0-4-0 leaves the station on the Lewiston railway.



Photo 13: The Gauge 3 Society presentation.

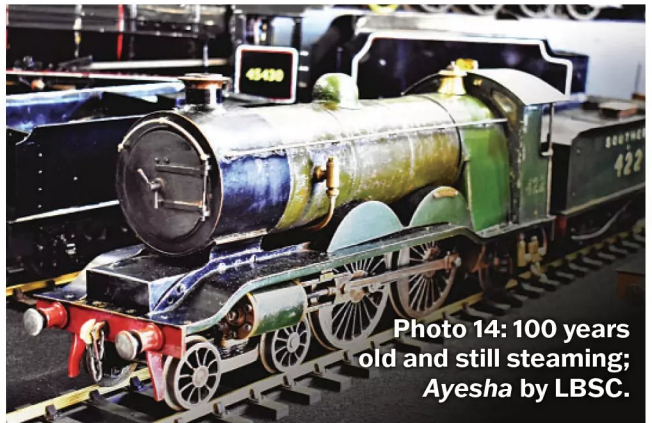


Photo 14: 100 years old and still steaming; Ayesha by LBSC.



Photo 15: The little BR Eastern Region electric shunter at work on the Barley End layout.



Photo 16: Plenty of activity on the 16mm Association presentation layout.



Photo 17: A nicely made overhead cable system on the 16mm Association display.



Photo 18: An overall view of the extensive Roche Junction display.

This model is now 100 years old and still fully certified to be steamed. It just shows that when something is looked after correctly it will last a long time, **photo 14**. A nice little end-to-end layout was that of **Barley End**. Depicted as a rural country halt, it has a small goods yard and engine shed with an adjacent warehouse which provides all the familiar railway activities. It had some interesting locomotives on show as well, particularly the little LNER 0-4-0 electric shunting engine which added a further authentic touch, **photo 15**. The 16mm Association Modular Layout, **photo 16**, was another large and interesting railway with, again, lots of colourful attributes and movement to keep everyone entertained. There was a variety of motive power and rolling stock combined with some good scenic

detail. The overhead cableway drive module was a fine piece of modelling in its own right, **photo 17**.

A large G scale layout, **Roche Junction** was modelled to depict a main line station with single line extension. This required all trains to stop before accessing the single line. Some very picturesque scenic work, including buildings under construction, provided another eye-catching presentation with plenty of fascinating railway movements operated by a variety of stock, **photo 18**.

The Leamington and Warwickshire Model Railway Society had a display of posters and leaflets showing the activities available at their site. All the recognised garden railway gauges are catered for in a landscaped setting with good vehicular access, and all just minutes from the M40 motorway (Junction 12).

That concludes my notes on this year's Garden Rail Show which I think had something for everyone interested in these particular scales. An excellent array of trade stands provided many different products and equipment and I noted one stand sporting a fine selection of scale model buildings, representing examples of the high and improving quality of present-day wares. Thanks to everyone who attended; I am sure you all enjoyed yourselves and the organisers look forward to seeing you all again next year. If you are interested in larger scale model engineering, however, why not make a note of the **Midlands Model Engineering Exhibition** to be held in this venue from Thursday 16 to Sunday 19 October 2025. It is sure to be a great day or two out. 🚂

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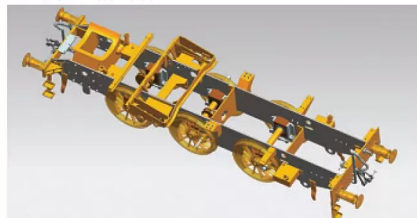
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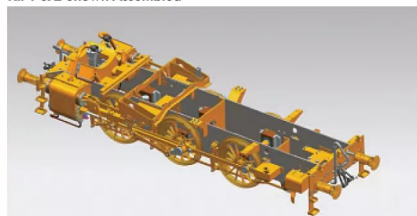
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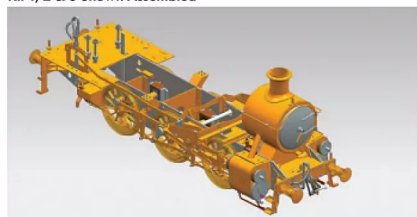
Kit 1 Shown Assembled



Kit 1 & 2 Shown Assembled



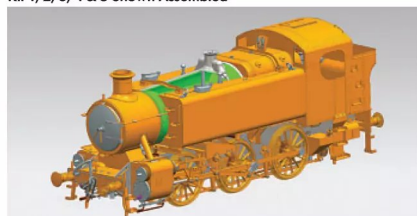
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- Silver soldered copper boiler
- Boiler feed by axle pump, injector and hand-pump
- Multi-element superheater
- Drain cocks
- Safety valve
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ME&W



Photo 2: Each SuperPump has an exhaust hole near the top and a securing screw above the hole.

Caledonian

A Resin Exhaust Shroud

Marcus Bowman tackled an unusual design challenge that led him to learn a lot more about using 3D printing resins.

I've never been a fan of standing in cold water, but there's a site high up in the hills near here which is popular with gold panning enthusiasts who spend lots of time in the river seeking their fortune. There's a bit more to it, of course, and the successful gold prospector not only needs to know where to look but can speed up the process of separating gold from dirt by using the right tools and equipment. I have a friend who manufactures and sells equipment for just that purpose; although I have never been gold panning, I am inclined to take an interest in the processes involved in making these items and often discuss the various challenges in design and manufacture which arise. Sometimes, I learn something new, whether that's knowledge about materials or a skill that can be applied to other things which don't involve standing in the river.

I have a SuperPump, **photo 1**, which is a hand pump designed to suck up

material from a riverbed and deposit it in a bucket so that it can be examined later, in a gold pan. The main tube is plastic, and the handle moves a soft piston up and down, creating suction or expelling material and water very effectively. As the piston rises, it draws in water, but the air above the piston needs somewhere to go, so there is a hole near the top of the tube which exhausts that air, **photo 2**. Water does tend to leak slowly past the piston, so after the pump has been used for some time what's expelled is a mixture of air and water. The inconvenient feature is that if the hole is facing the operator, the exhaust guarantees a soaking. That's fine if you are wearing a wet suit or dry suit, but not so handy if, like me, you are wearing jeans while using the pump to clear a domestic drain. So the question arose: Can we design an attachment to direct the exhaust downwards rather than at 90 degrees to the pump body?

After some head scratching, we

came up with a 'simple' design for an exhaust shroud, **photo 3**. The shape is surprisingly complex because of the design intent. The key factors were:

- Must exhaust enough air to avoid pressure build-up inside the pump above the piston;
- Must fit the curved body of the pump, to avoid leaks around the side or top;
- Can be secured at the top by an existing screw;
- Needs to be secured in, or over, the existing exhaust hole, so that it does not require a change in the current manufacturing method for the pump body.

That last requirement complicated the design considerably but there was another factor which became apparent much later and that's where we learned something new and important. In fact, we learned most from the unexpected failure of the first prototypes, for reasons we had not considered.

THE DESIGN

Creating the design in CAD proved to be a real test of my existing skills and **photo 4** is a render of the end result. The drawing challenge is that this is a much more complex shape than I imagined, with not a single flat face, so lofting between adjacent curved faces, extruding by revolving and even just creating the blending surfaces between faces proved to be a test, both of my skills and of the capabilities of the software. In the initial stages, the shape I visualised inside my head seemed likely to be quite simple, but it's certainly not the kind of object that would be easy to sketch on the back of a fag packet. It's the subtleties that make this such a challenge. Part of learning how to use any software package involves aligning your thinking with the concepts the software engineers have used and it's a bit like getting inside their heads so that you are in sympathy with the way the package actually works. Although the idea that software has limitations or bugs is often used as an excuse, software at this level is hugely capable and most frustrations are with our own pre-conceptions of what it should do and how it should behave. It is true, though, that there are real instances where the package doesn't quite do what it really should. One instance in Fusion 360 was the limitations on how it attempts to create embossed text on a complex curved surface.



Photo 1:
SuperPump,
used for
sucking up
material from
a river bed.

What you see in photo 4 requires two workarounds and much searching for answers on forums. I expect that will improve with each update of the software.

As is often the case, the process of drawing in CAD reveals aspects that are really only apparent in a 3D drawing, even when that is only viewed on a 2D screen.

Photograph 3 shows a countersunk hole for attachment by an existing screw and photo 4 shows a small flange at the back of the shroud which is designed to sit inside the pump body to keep the bottom of the shroud against the face of the pump. That flange is just small enough to fit through the centre of the existing exhaust hole, but the wings are large enough to catch on the inside of the pipe when the shroud is slid downwards until the screw hole aligns with the hole for the existing screw on the pump.

MAKING THE SHROUD

A nearby plastics factory produces a lot of the gold panning equipment by vacuum moulding, centrifugal moulding, pouring into a mould or dipping, but none of those processes lent themselves to production of the exhaust shroud. There was some discussion about injection moulding, which that factory does not do, but the problem is that the tooling for injection moulding tends to be expensive. Experience also suggests that the design of individual parts like the shroud inevitably evolves over time and each alteration of an injection moulded part would require new, expensive, tooling. I am not convinced this shape would lend itself to injection moulding, but we should have given more thought at

the design and drawing stages to the constraints imposed by manufacturing methods. Creating a 3D shape in CAD is all very well, but not if it can't be made in the real world.

It is nearly true to say that, with care at the design stage, 3D printing can produce almost any shape that can be drawn, so the first few shrouds were produced on my resin printer using standard 'ABS-like' resin. Before printing, this design had to be tweaked just a little to suit the way a resin printer operates. The main consideration was that the surface area of the shroud in contact with the printer's build plate must be sufficient that the first layer of resin can get enough grip on the plate for the whole shroud to remain attached during printing. The base of the shroud is a thin edge which has rather a small surface area, so I thickened the rear attachment flange and flattened its lower edge so that it was at the same level as the bottom of the shroud. That considerably increased the surface area of the bottom of the shroud, **photo 5** and because the shroud is printed upside down, hanging from the build plate, the larger area improved the grip.

There are competing forces at work during printing. The first is the strength of the grip of that first layer, which keeps the object attached to the bed. The second is the force exerted by the bottom layer each time a new layer of resin is cured next to the FEP film in the bottom of the vat of resin. FEP stands for Fluorinated Ethylene Propylene, a softer, more flexible and melt-processable relative of Teflon. The FEP is slightly flexible and when the build platform rises, the FEP stretches upwards because it is stuck to the new layer on the bottom of the object, until the object is pulled off the

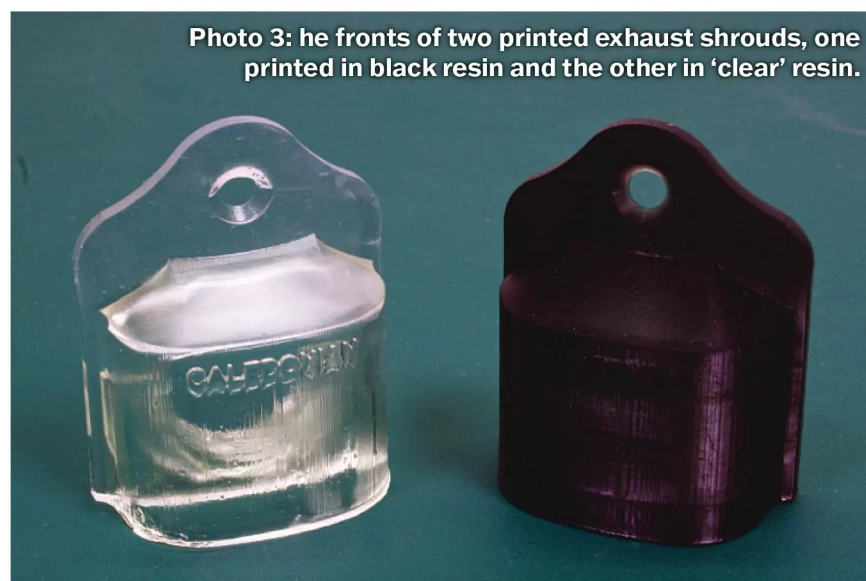


Photo 3: the fronts of two printed exhaust shrouds, one printed in black resin and the other in 'clear' resin.

Photo 4: A CAD drawing showing the rear view of an exhaust shroud with its attachment flange.

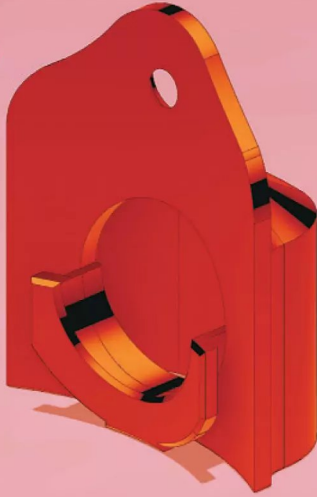


Photo 5: A view from underneath the shroud, as shown in the slicer. The green indicates the area of contact with the build plate.

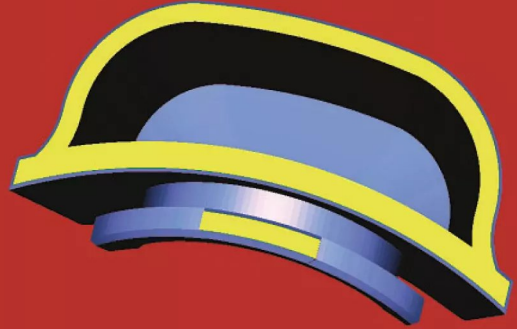


Photo 6: A view from within the slicer showing the shroud linked to the build plate by supports.

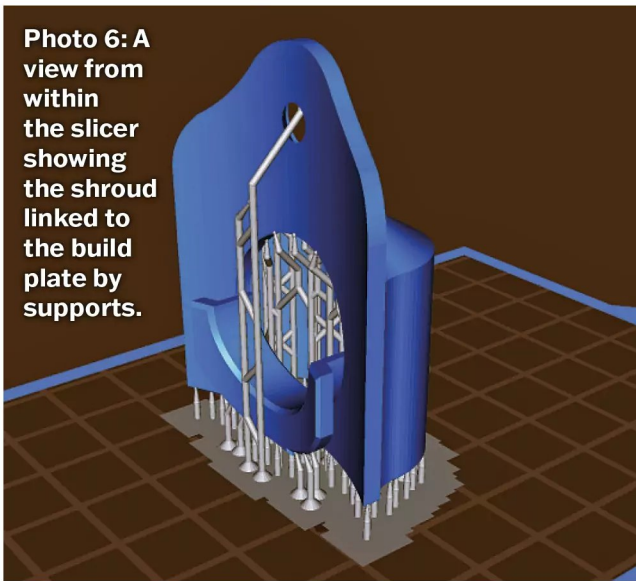
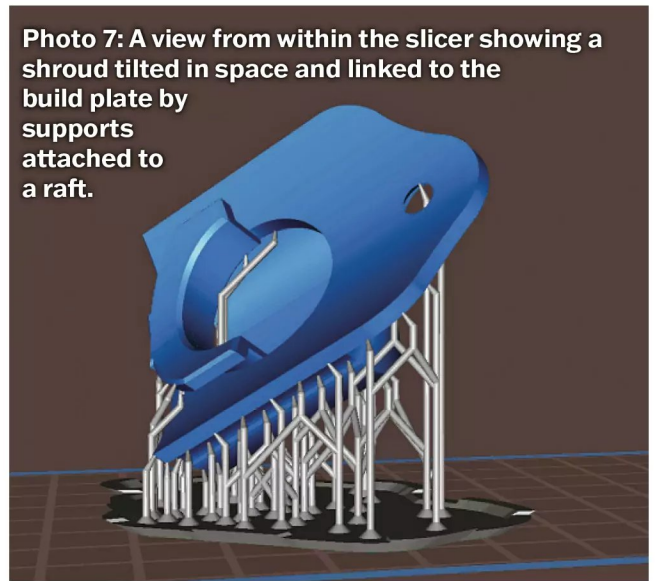


Photo 7: A view from within the slicer showing a shroud tilted in space and linked to the build plate by supports attached to a raft.



FEP. For that to happen, the first layer of the object, next to the build platform, must be more securely attached than the last layer, next to the FEP. If the FEP is too strongly attached, the object will part company with the build platform and we have a catastrophic failure of the print.

Experimentation with exposure times can reduce this problem and reducing exposure time can result in a lower grip between object and FEP. The downside is that may also reduce the adhesion between the previously cured layer and the current layer. The slicer software can also be set up to use a longer exposure time for the first few layers and shorter times thereafter, ensuring the strongest bond will be between the first layers and the build plate.

Another way of dealing with this situation is to use the slicer to position the object a short distance away from the build platform, attached to the platform by supports, **photo 6**. That

freees the object from the restriction that it must be attached directly to the build plate. Supports also allow the object to be printed lying at an angle, which may allow more, possibly larger, supports. The supports often look like short cylinders or tree branches. Supports can be quite thin and numerous so they may be accompanied by a raft, which is a solid sheet designed to provide a larger area to give greater grip against the build platform, **photo 7**. In my opinion, the big drawback is that supports need to be cut off the finished printed object and the residual fragments removed by filing or scraping. That would add considerably to the time required to produce a finished object and I much prefer printing without supports if at all possible.

My preferred way of reducing attachment to the FEP is to prepare the FEP before resin is added to the vat, by wiping a very thin layer of 'Dry PTFE' lubricant over the FEP and letting it dry

for a short time, **photo 8**. The FEP will then look a little cloudy, but its performance will not be impaired. The PTFE reduces the grip the last layer will have on the FEP. Since adopting this method, I have not experienced a print failure from this particular cause.

A different challenge is removing a printed object from the build platform. The grip can be so strong that prizing the object off the platform or swiping its lower edge with a large knife or any similarly violent technique can damage the print. So it was with the printed shroud. This is not a new problem but it was solved by adding a thin and flexible steel plate to the build platform, using a sticky-backed magnetic pad applied to the surface of the build plate, **photo 9**. The print is then attached to the thin plate and removal is simply a matter of prizing the plate from the magnetic pad and flexing the plate to release the print, **photo 10**. This works wonderfully well, giving a clean, damage-free surface

which requires no further clean-up apart from the usual wash in isopropyl alcohol.

AN UNEXPECTED FAILURE

After a couple of test prints we seemed to have achieved a workable shroud. Success is such a nice feeling. But wait... Ah! We hadn't thought of everything!

All was well until I dropped the pump. The shroud hit something solid and shattered. Not cracked or chipped but

shattered. Maybe that was a one-off? Maybe the pump would not be subject to such misfortune in normal use? Given that these pumps were intended for prolonged operation amongst rocks and stones, in cold, cold water, it seems quite likely that a shroud like this would shatter.

To confirm this was not a one-off, I printed a small batch of shrouds and conducted a simple test. Printing a batch of 10 shrouds took exactly the same length of time as printing just one because it is only the vertical up-and-down motion of the build plate that takes time, so it is only the height of the objects that determines the time. Within the slicer software I simply cloned the single shroud and placed nine additional copies onto the build plate.

My test involved repeatedly placing a cured shroud on the bench and smacking it with a small hammer, swung under its own weight from elbow height. Not totally scientific but

realistic enough for the purpose. All the shrouds shattered, so there was clearly a problem and it seemed there was more to learn about resins.

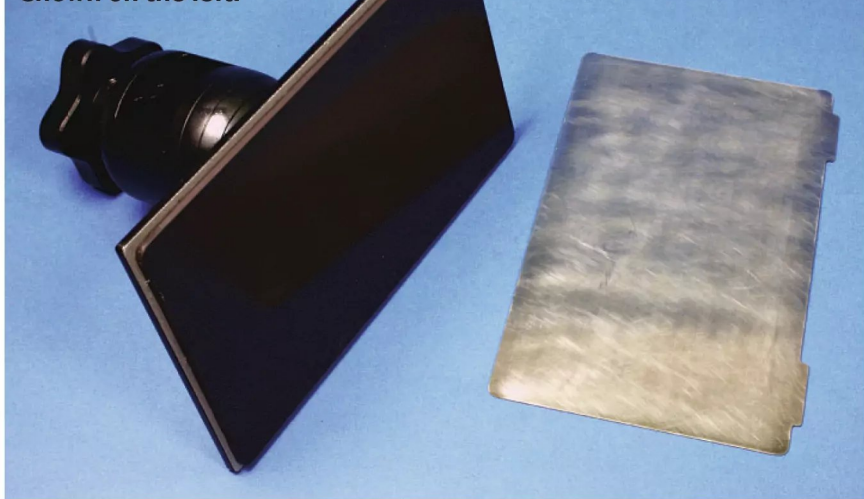
ENGINEERING RESINS

Resins divide into water soluble and alcohol soluble varieties. When a print is removed from the build plate, excess resin is washed off the surface using either water or isopropyl alcohol. The surface of the print is then cured by exposure to UV light, irrespective of the type of resin. When I bought my first bottle of resin I chose water-washable, thinking this would make cleaning easy. It did, but the problem was that the resin contaminated the water, which could not then be put down the household drain. Not so handy. Isopropyl alcohol smells, but heavily contaminated alcohol can be filtered and re-used. A resin/alcohol mix can also be made semi-solid by leaving it out in sunlight or exposing it to UV light.

Photo 8: Dry PTFE spray. One or two drops can be spread thinly on the FEP.



Photo 9: A flexible steel plate, shown on the right, can be attached to a magnetic pad glued to the build plate, shown on the left.



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In the past, I have tested the water-resistant properties of water washable resin by immersing a test piece in a jar of water for a week. Despite all claims to the contrary, I found the test piece absorbed water, swelling a small amount. It also softened and was prone to crumbling under a light load. For a print intended to work in water, this would not be a good choice of resin type.

Most common resins are described in imprecise terms such as 'Standard' or 'Abs-like', but there are no details of their exact composition and I can find no real difference between the performance of the prints they produce.

There are, however, others categorised as 'engineering resins', all of which make specific claims about their properties. The reason they are not more widely used by enthusiasts is probably the cost, which is much greater than the standard resins. It was amongst these engineering resins that I found a workable solution to my problem. Resin printing is used commercially for production runs as well as for prototypes, so it is no surprise that there are resins with a chemistry that provides them with specific properties such as toughness, durability, elasticity, resilience and the ability to withstand heat. There are also resins designed for medical purposes, including dental resins. Investment casting, for dental or jewellery work, uses prints which hold fine detail yet will leave no residue when they are burned from a mould.

Several manufacturers provide specific details of the properties of their resins, such as tensile strength, elongation at break, impact strength and heat resistance. Those manufacturers state that standard (ABS-like) resins have a relatively high tensile strength but a low elongation at break, indicating that they are brittle and one manufacturer says that standard

resins are 'not suitable for functional parts' (hubs.com).

Ductility is the ability of a material to stretch rather than break under a tensile (pulling) force and elongation at break gives an indication of ductility.

Elasticity is the ability of a material to return to its original shape after being stretched or squashed (compressed). When a material reaches its elastic limit, it can no longer return to its original shape. It may not have broken but it has been permanently deformed.

Resilience is a measure of a material's ability to absorb energy when it is elastically deformed and release that energy when the force causing the deformation is removed.

Intuitively, you can see that ductility, elasticity and resilience are related. The hairspring in the escapement of a watch coils and uncoils repeatedly as a result of force indirectly applied by the main spring. That hairspring has ductility because it can stretch without breaking, elasticity because it returns to its original shape and resilience because it absorbs energy from the main spring as it coils up but returns it as it uncoils by powering the balance. Without ductility the hairspring would not act as a spring and would simply break. Without elasticity it would distort as it wound or unwound and would not be able to operate for long. Without resilience, the spring would absorb energy as it wound up but would not return it to keep the balance oscillating, so there would be a tick but no tock and the watch would stop. So the hairspring works because it is ductile, elastic and resilient.

Toughness is a measure of the amount of energy a material can absorb before it ruptures. This is related to a material's ability to withstand shock loading like my hammer test. Tough material may permanently deform before rupturing, but toughness is related to ductility and, to a lesser extent, elasticity. Shrouds from that first batch printed with ABS-like resin were neither tough nor ductile and must have had very low elasticity.

TOUGH RESINS

For the shrouds, the resins which seemed to match the requirement for impact resistance were tough (withstanding impact well), somewhat flexible (ductile) and would return to their original shape after impact (elastic). I eventually settled on a bottle of SirayaTech Tenacious resin, based on the statements that this was a 'durable' resin with 'excellent impact resistance, flexibility and toughness'. At four times the price of my normal standard resin, I had high hopes. The resin was available in clear or obsidian black. Aesthetically, I needed the black, but could not find a supplier so my plan was to buy the clear resin and colour it with an epoxy resin dye made for the purpose (following the instructions at <https://facfox.com/docs/kb/how-to-dye-resin-3d-prints>). An alternative would have been to use a powdered pigment, but the success of that technique seems to depend on using a pigment with a very small particle size. None of the pigment powders I could see stated their particle size, so dye seemed the best bet.

Printing a batch of shrouds was quite straightforward and I followed the manufacturer's recommendations for exposure times. That's quite important, because the times for each resin vary depending on the manufacturer's mix and the colour of the resin, as well as the ambient temperature at which printing takes place. Some experimentation is needed when using a new make or colour of resin but the manufacturer's suggestions usually provide a good starting point. In this case, SirayaTech provide settings files which can be downloaded, imported into the slicer software and then selected from a



Photo 10: Prints about to be released by flexing the steel plate.

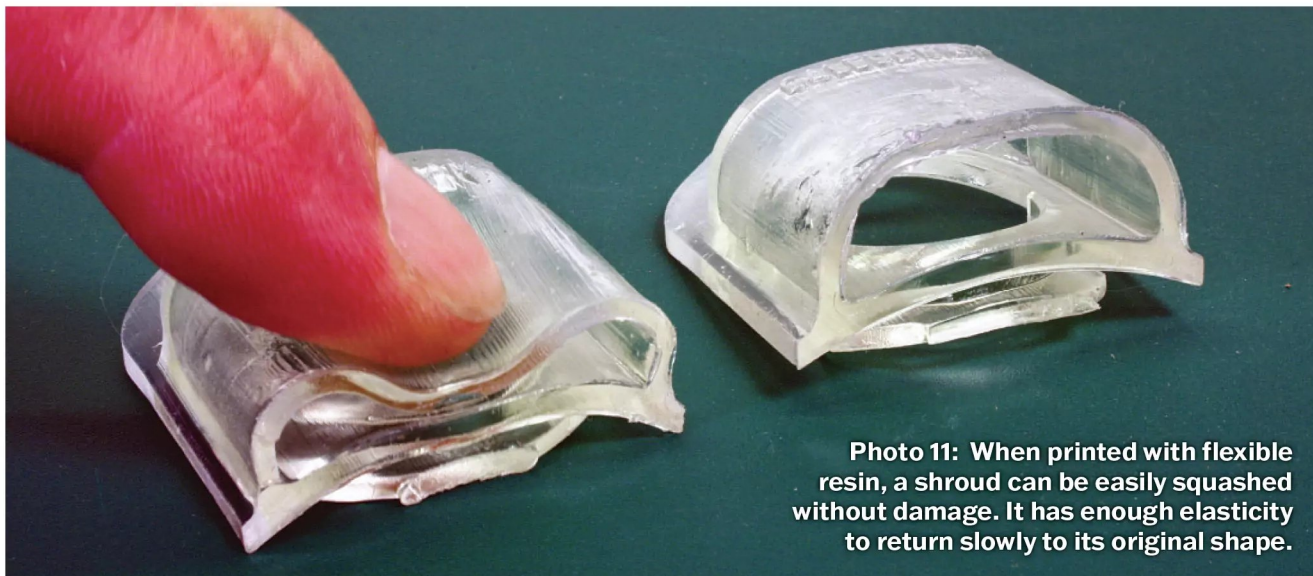


Photo 11: When printed with flexible resin, a shroud can be easily squashed without damage. It has enough elasticity to return slowly to its original shape.

menu. One noticeable difference was that despite the flexible build plate, the flexibility of the printed shrouds allowed them to accommodate the flex and continue to grip the plate firmly, making removal a challenge. A second difference was that post-printing UV curing required a considerably longer exposure time, possibly because the transparent resin allows a lot of UV light to pass straight through. Despite the resin being 'clear', the uncured prints have a faint yellow tint, which becomes a little more pronounced during post-print curing.

Testing the batch was a revelation. I could squash the shrouds, **photo 11**, hit them hard with a hammer, twist them a little and bend the top attachment flange through 90 degrees, **photo 12**, but I could not break them. They recovered their shape, although slowly. Despite the impressive performance they did seem just a bit too flexible.

Next, I tested a mixture of Tenacious Clear and standard black ABS-like resin, a combination suggested in the manufacturer's notes and that seemed to dampen the Tenacious properties just a little. However, that would complicate manufacture because it would require a mix with consistent proportions of the two resin types, so I had some reservations about this. The black colour was not solid but gave a dim semi-transparent appearance, which was not what I wanted.

Given that the availability of the Tenacious in the obsidian black colour seemed inconsistent, I moved on.

The next choice was AnyCubic Tough resin, described as 'highly resistant to compression, stretching and bending without breaking' and available in black. Shrouds printed using this resin are slightly less flexible than with Tenacious resin but seem equally resistant



Photo 12: A flexible shroud can be bent or rolled up without damage.

to breaking. There is no requirement to mix resins to achieve the desired properties. The cured shrouds exhibited much the same semi-transparency as the mix of Tenacious Clear and ABS-like black resins, but this was solved by thickening the front walls of the shroud, which had the additional bonus of increased strength.

The reduction in flexibility of these shrouds meant they could be released from the build plate by flexing it and the final curing took approximately the same time as ABS-like resin.

Other engineering resins are available with specific properties such as

- flexibility (RESIONE F69; FORMLABS Flexible 80A);
- elasticity (RESIONE F90; FORMLABS Elastic F50A);
- rubber-like properties (RESIONE);
- certified flame retardant (FORM-LABS);
- castable (LiqCreate Castable; Bluecast X5; Phrozen Wax-like Castable; Formfutura Castable wax resin).

Some of these are two or three times the price of standard resin, while others cost much more. The cost tends to reflect the usefulness of the resin,

the specific claimed properties and the fact that, at least for prototyping, they do represent value for money and are well worth investigating for any project which requires prints with specific characteristics.

Injection moulding tools are expensive and may not suit some complex shapes, but 3D printing is now a recognised volume production method and these pump exhaust shrouds can be printed reliably and repeatedly in one of the many commercial 3D print 'farms'. They can also be printed successfully in the workshop using a small resin printer thanks to the PTFE on the FEP and the addition of a flexible steel build plate surface - and the choice of resins means their real-world performance is at least as good as we hoped for at the design stage. As a bonus, the additional knowledge about engineering resins has already resulted in benefits for other projects including replicating shatter-free, clear, glass-like light panels in a cooker hood using AnyCubic Tough Clear resin. Other clear resins are available, of course, with some recent additions claiming to provide 'crystal clear' prints. 🌟

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2025

EVERY SUNDAY

Warrington MES
Running day. Contact :
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APRIL

16 LEEDS SMEE

Nigel Bennett - 'Invicta'.
Contact: Judith Bellamy,
jabellamy29@gmail.com

18 ROCHDALE SMEE

Nattering in the hut
(Community Centre closed).
See www.facebook.com/RochdaleModelEngineers

20, 21 CARDIFF MES

Public running day, Heath
Park Cardiff. www.heath-parkminiaturerailway.co.uk

24 GUILDFORD MES

Public open day, Stoke Park.
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MAY

2 ROCHDALE SMEE

Models running night.
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17:00 onwards. See
www.facebook.com/RochdaleModelEngineers

7 LEEDS SMEE

John McGoldrick - Leeds
Museums. Contact: Judith
Bellamy, jabellamy29@gmail.com

10 BROMSGROVE SME

Open Day
All gauges are welcomed
5", 3.5", 2.5", G.1 and 16 mm.
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524836

16 ROCHDALE SMEE

Alf Molyneux - 'Travels with
Fred Dibnah'. Castleton
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18 GUILDFORD MES

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Park. Contact: Mike Sleigh,
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21 LEEDS SMEE

Geoff Rogers - Traction
Engine. Contact: Judith
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25,26 CARDIFF MES

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29 GUILDFORD MES

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JUNE

1 GUILDFORD MES

Small Model Steam Engine
Group meeting, 14:00-
17:00, Stoke Park. Contact:
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6 ROCHDALE SMEE

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20 ROCHDALE SMEE

Bob Hayter - 'Evil Spirit'.
Castleton Commu-
nity Centre, 19:00. See
www.facebook.com/RochdaleModelEngineers

29 CARDIFF MES

Public running day, Heath
Park Cardiff. www.heath-parkminiaturerailway.co.uk

JULY

4 ROCHDALE SMEE

Models running night.
Springfield Park,
17:00 onwards. See
www.facebook.com/RochdaleModelEngineers

5/6 GUILDFORD MES

Railway Gala, 10:00-17:00,
Stoke Park. Contact:
Mike Sleigh, pr@gmes.org.uk or see www.gmes.org.uk

5 BROMSGROVE SME

Modern Traction Open
Day. All gauges welcomed
5", 3.5", 2.5", G1 and
16mm. Contact Doug
Collins 07585 524836
18 Rochdale SMEE
General meeting. Spring-
field Park, 17:00 onwards.
See www.facebook.com/RochdaleModelEngineers

20 GUILDFORD MES

Public open day, Stoke
Park. Contact: Mike
Sleigh, pr@gmes.org.uk
or see www.gmes.org.uk

20 CARDIFF MES

Public running day,
Heath Park Cardiff. [www.heathparkminiaturerail-](http://www.heathparkminiaturerailway.co.uk)
[way.co.uk](http://www.heathparkminiaturerailway.co.uk)

AUGUST

1 ROCHDALE SMEE

Models running night.
Springfield Park,
17:00 onwards. See
www.facebook.com/RochdaleModelEngineers

3 GUILDFORD MES

Small Model Steam
Engine Group meeting,
14:00-17:00, Stoke Park.
Contact: Mike Sleigh,
pr@gmes.org.uk or see
www.gmes.org.uk

3 CARDIFF MES

Public running day, Heath
Park Cardiff. www.heath-parkminiaturerailway.co.uk

7 GUILDFORD MES

Public open day, Stoke
Park. Contact: Mike
Sleigh, pr@gmes.org.uk
or see www.gmes.org.uk

15 ROCHDALE SMEE

Auction Night. Castleton
Community Centre, 19:00.
See www.facebook.com/RochdaleModelEngineers

17 GUILDFORD MES

Public open day, Stoke
Park. Contact: Mike
Sleigh, pr@gmes.org.uk
or see www.gmes.org.uk

24, 25 CARDIFF MES

Public running day, Heath
Park Cardiff. www.heath-parkminiaturerailway.co.uk

28 GUILDFORD MES

Public open day, Stoke
Park. Contact: Mike
Sleigh, pr@gmes.org.uk
or see www.gmes.org.uk

SEPTEMBER

6 BROMSGROVE SME

Open Day. All gauges
welcomed 5", 3.5", 2.5",
G1 and 16mm. www.bromsgrovesme.co.uk.
Contact Doug Collins
07585 524836

14 CARDIFF MES

Public running day, Heath
Park Cardiff. www.heath-parkminiaturerailway.co.uk

19 ROCHDALE SMEE

Bits and pieces/personal
project ideas. Castleton
Community Centre, 19:00.
See www.facebook.com/RochdaleModelEngineers

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A&S 1ES milling
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very nice example! £3450



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£9750



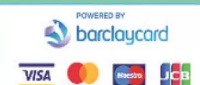
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POSTBAG

The Editor welcomes letters for these columns, but they must be brief. Photographs are invited which illustrate points of interest raised by the writer

Readers! We want to hear from you! Drop us a line sharing your advice, questions or opinions. Why not send us a picture of your latest workshop creation, or that strange tool you found in a boot sale? Email your contributions to meweditor@mortons.co.uk.

THREADING 1.75MM PITCH ON THE ENGINEERS TOOLROOM LATHE

Dear Readers, not long after Issue ME&W 4763 went to press, the Editor received an email from Howard Lewis apologising that his proposed solution to Peter Hardy's threading problem was incorrect. He then received some suggestions for a solution from Brian Wood. Over the following weeks the three of us had a multi-way debate on the best solution. Unfortunately although entertaining and informative it is too complicated to do anything other than summarise it! Howard helpfully supplied details of the lathe and the change gears available, and Brian came up with some potential

change gear and gearbox settings. In the end we all agreed that the main problem is the lack of a change gear that would allow a 35:40 or 70:40 ratio to be used with the gear box set up for 2mm or 1mm thread pitch. Unfortunately, the lathe does not come with one. Brian eventually found two organisations supplying gears in Mod 1.25 in a material called Hostaform, a form of acrylic plastic. The prices for a wheel of 35 teeth are really quite reasonable. They are available from Bolton Gears and Bearing Boys. Both can be found easily online. We think this is the easiest solution to Peter Hardy's problem. Good luck, Peter!

Brian Wood, Howard Lewis and Neil Wyatt.

SUGAR CANE LOCO

Dear Neil, Ron from Australia enquires after *Australian Model Engineer magazine (AME)*. It ceased publication in Jan/Feb 2021, Issue 214. I'd bought it via Camden Miniature Steam since issue 98. If he's referring to *Wombat*, an 0-4-0 tender loco for 5" and 7 1/4" gauges then the series ended incomplete at Part 21. I've no contact for David Proctor, but E & J Winter have castings, drawings and parts available (in Australia).

There's also an *AME Wombat* Locomotive Builders Group on Facebook.

AME was a great read, and they featured some interesting loco projects. A 7 1/4" gauge Bundaberg Fowler 0-6-2 was interesting, but big. I hope this is of some help,

Jonathan Palterman, New South Wales, Australia

GREEN ARROW

Hi Neil, Martin Evans did an article in *ME* for a Loco called Green Arrow. This would be around 1972. Volume 138 Number 3439 has part XIII. Is it possible to say which Volumes and numbers the remaining parts appeared in please?

Peter Russell, by email.

Hi Peter. For older volumes of the magazine, there are several online indexes to *Model Engineer*, I find this one particularly useful: http://www.imes.org.uk/me_index/. If you click on the *Model Engineer* link, then enter 'green arrow' all the issues you seek are listed around pages 3 & 4 of the results- Ed.



PARTING EXPERIENCES

Dear Neil, the article by Bruce Porteous on the making of a Spring Parting Off Toolholder strikes me as well written, well researched and illustrated with clear drawings and pictures. Kudos! However a word of caution may be appropriate for those considering embarking on following Bruce's example. The other day I presented my recently constructed rear toolholder equipped with a similar professional spring parting off toolholder to members

of my horological society. Rather than getting the hoped for compliments, several members commented that the spring parting off toolholder did not work out satisfactorily on their own lathes. Our lathes are mostly older professional toolroom lathes with about 500 mm between centres, like Schaublin from Switzerland, Weiler from Germany, Maximat from Austria or Al Hembrug from the Netherlands. Their advice was to negate the spring-effect by closing the gap with a weld or by putting a

steel block in the gap.

They concluded by pointing out that nowadays very good performing toolbits plus holders of the type SP200 can be had locally or online at a very reasonable price. So I would suggest that anyone contemplating the construction of a Spring Parting Off Toolholder starts with testing whether the device will be effective on his/her particular lathe. I'm sure fellow model engineers will be open to support such a try-out by making available their own tools.

Peter Chevalier, by email.

RIO GRANDE RAILWAYS AND THEIR MOST BEAUTIFUL LOCOMOTIVE

As a Swiss fan of the former Rio Grande Railways and their steam, I am on the one hand a subscriber of the US-American magazine *Live Steam And Outdoor Railroad* and on the other hand the British counterpart *Model Engineer*. I'm also a member of a miniature railways club and own an English live steam loco (Standard Class 4) in the common (in Europe) gauge of 5 inches / 127 mm. My

dream is to drive a Rio Grande K27 on 5 inch tracks, because – in my opinion - it's the most beautiful steam loco ever built. A holiday trip is planned to Colorado and surroundings for a ride on the Durango-Silverton and the Cumbres & Toltec RR. I've bought Kozo Hiraoka's fascinating books for the building of this engine and realised that there obviously are no castings or even a kit for this model in the European 5 inch gauge. I've neither the skills nor the needed time (in years) - for building the engine without this.

I suppose that in the US the chance to find such aids is still worse than in good old England, but I try it anyhow. Some years ago, there was a supplier of a K27-kit in Germany, but it no longer exists.

Do you perhaps have ideas or addresses where I could get this?

Peter Hunziker, Switzerland.

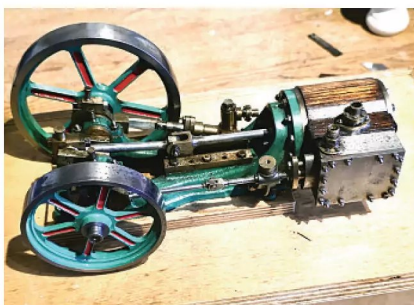
Hi Peter, it's just possible that a reader is aware of an unbuilt or part-built example of the German kit – Ed.

MYSTERY ENGINE

Hello Neil, Mr Moxon's mystery engine (ME&W 4763) is a Stuart Turner No 9 which has had some extra detail added to it and rather nicely too. The presence of oil around it tells me that it has been run, which is rather encouraging...

One of the wonderful things about model engineering is that it's so easy to add a little (or a lot) of extra detail at any time (try doing that to a plastic kit) to enhance one's creation and make it different from everybody else's.

Looking at the high quality of the build with the jaundiced eye of someone who judges at SMEE compo days, I think the builder has been familiar with engineering and possibly full sized small stationary engines or has spent quite a lot of time looking at photos of them, which has inspired him to add some appropriate extra detail. This one has an additional flywheel outboard of the eccentric, the original model's rather clumpy flywheel spokes have been thinned down and fluted to match and the



slidebars have had extra oil holes added. Along with that, the steam chest and cylinder cover have had extra studs and nuts fitted and oil cups grace the main bearings while the steam inlet and exhaust have been given flanged fittings with a suitable number of studs and nuts. I wonder if the engine was ever really fully completed as the steam chest cover's studs are all sorts of lengths and the eccentric rod's guide casting has provision for a governor (the hole is tapped for the governor shaft) but the governor itself is missing. The Stuart kit has two options for this, the other one being for builders who don't

want to fit a governor, but this one has already been machined for one.

The model itself does look rather well made and it'd be nice for the eventual purchaser to know the name of the builder as I feel that far too many properly engineered steam engines like this are sadly anonymous! To me it's a bit like not signing a sculpture or painting that one has created.

As for selling it, it's now free to sell on eBay and a model like this one will certainly garner a lot of interest and a good price. Similarly, auction houses such as Dreweatts and Lacy Scott and Knight between them, hold several sales each year that include engineering models as do other auctioneers. Do remember though, that with auction houses, the seller often (but not always) pays the auctioneers a percentage and the buyer certainly does!

I hope this helps Mr Moxon make some decisions: the model will certainly grace any collection of stationary engines and if it comes up for sale, I'd be very tempted to bid on it!

Mitch Barnes, by email.

WHEEL STANDARDS

Dear Neil, In a rather desultory letter (ME&W 4763) MJP of Louth indicates that there are no unified wheel standards for model locomotives and that the designs of Martin Evans should therefore be followed. Rather surprisingly, our worthy editor seems to agree.

In fact, unified wheel standards have been available for decades. The SMEE produced standards for gauges from 2 1/2" to 7 1/4" and these were published in ME, 7th May 1976. To save MJP from trawling through back copies of ME, the table of profiles is available on the website of the Bristol Society of Model Engineers, and no doubt elsewhere also.

For 5" gauge models, GL5 promulgates a standard profile based on the work of the brilliant model engineer and author, Doug

Hewson. This standard is pretty much universally accepted, and I would advise MJP to use it.

For 7 1/4" gauge models, the Seven and a Quarter Inch Gauge Society also promulgates a standard profile. Both this and the GL5 profile can easily be found on the internet.

MJP's suggestion that 'a few basic rules' are required is not really relevant, all of the information is out there already. I'm not sure what further information MJP might require, but I'd be happy to help out if need be.

Tim Coles, by email

Hi Tim, it's certainly true these standards exist for the UK, but nonetheless there are variations. For example, in the 1990s there was considerable debate on wheel coning that I don't think was ever properly resolved. The thoughts of readers on these issues are welcome - Ed.

THE FUTURE OF MODEL ENGINEERING

Dear Neil, like Paul Reeves (The New Look Magazine) I had concerns about the merger of ME and MEW, but unlike him I am fully of the view that the merger anchors the magazine too much in the old technologies of the past. As he notes MEW was always more forward looking than ME, and the change, in my view, drags MEW back rather than taking the opportunity to propel it forwards. The future of hobby engineering is surely to be found within the Maker community rather than the steam community. Software and generative AI and self-calibrating CNC machines are the future, not milling in an analogue lathe or worshipping engines propelled by technology that risks the existence of humanity.

Dr Stewart Bryant, Surrey

My Life in Miniature!



Mark Noel describes the fun to be had applying model engineering methods to the tiny world of dolls' houses.



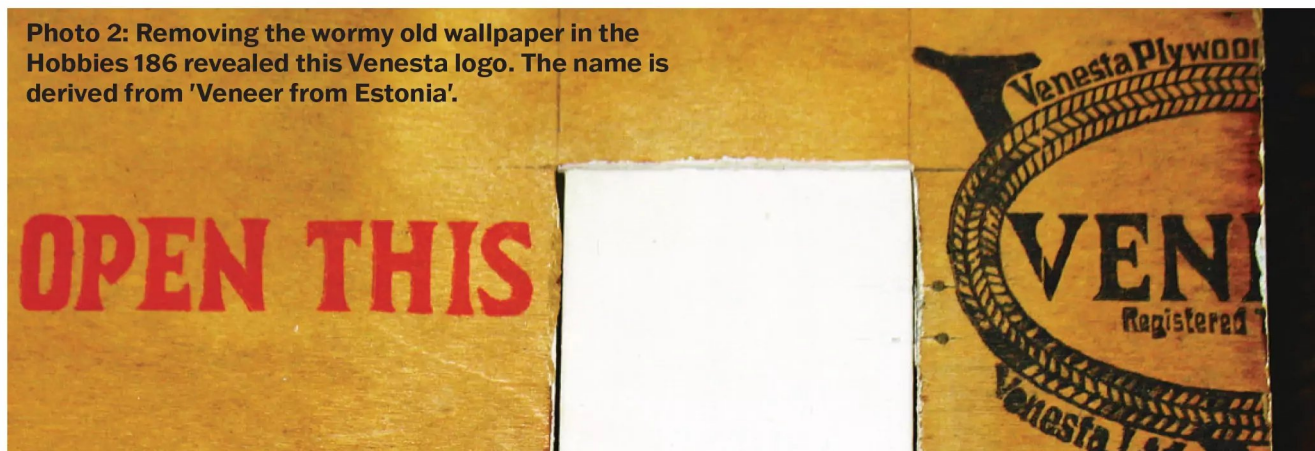
Photo 1: Hobbies Model 186 built from plans and completed in 1933 according to the inscription over the door. The plywood for the walls and floors was made by Venesta and probably sourced from old tea chests.

You might consider me a wealthy gentleman when I mention we own 25 houses in addition to the one we actually live in. But no, these are a collection of vintage dolls' houses that span the decades from 1930 to 1960 - a time that saw

growing popularity in this type of toy. Most were bought ready made from the likes of Triang and Amersham, while others were scratch-built by doting fathers from Hobbies plans using whatever materials were available. A good example is our Hobbies

Special Model 186 made in 1933 using Venesta plywood salvaged from tea chests - the same tea chests that formed the walls of Captain Robert Falcon Scott's hut from which he launched his failed attempt in 1911 to reach the South Pole, **photos 1 and 2**.

Photo 2: Removing the wormy old wallpaper in the Hobbies 186 revealed this Venesta logo. The name is derived from 'Veneer from Estonia'.



Recent years have seen a revival of interest in both dolls' houses and the miniatures that furnish them. This came into focus when we had a family visit to the Kensington Dolls' House Festival in autumn 2019. On display was an astonishing array of craftsmanship by silversmiths, potters, painters, glassmakers, cabinet makers and others in 1:12, 1:16 and 1:24 scales.

There were even perfect miniatures of garden implements and working long-case clocks that impressed and bewildered. To my surprise most of the stalls were being run by men, rather than by women, proving that this was a respectable hobby for me to join as a whiskered alpha male without having to assume a feminine disguise. Indeed, a recent article in MEW encouraged readers to apply their model engineering skills towards this activity, emphasising the satisfaction that it can bring.

As a successful miniature landlord I have responded to our tenants' requests for items to enhance their quality of life and this has led me to make the items shown in **photo 3**.

Most projects have been completed using material from the scrap box, taking a weekend or less, and our miniature tenants have expressed their gratitude and delight. Of course their rents were immediately increased as a result! Below we take a closer look at each item.

TWO-SECTION EXTENDING LADDER

Mega-maintenance for mini-houses is a perpetual task throughout our stock of older property and the ladder is always on the move from street to street and house to house for a wide range of jobs. Shown propped for window cleaning in **photo 4**, the ladder comprises side rails made from strips of old parquet flooring, with steps cut from cocktail sticks stained to match the rails. In the scrap box I found some lengths of 2.5mm wide stainless strip from a Mufax echosounder recorder (I once worked in oceanography) and this was bent and filed to form guides and

clips for the ladder structure before bonding with 5-minute epoxy, **photo 5**. The completed ladder extends from 8" to 14" which of course equals from 8' to 14' in the 1:12 scale world, ideal for general house maintenance by little people, **photo 6**.

TORCHERE AND BOWL

The posh family renting our large Triang Stockbroker house is furnishing in Victorian style with ornate furniture and wallpapers and was keen to include a mahogany torchere with brass bowl to impress the neighbours. Back in the day, this type of expensive plant stand was produced using a copy lathe that could turn barley twist forms with two or more flutes that might even be tapered. Using the power of Alibre Design I sketched a lobate cross section and used the helical extrude function to create the stem of the torchere with only a few clicks in the program, **photo 7**. Combinations of extrude and extrude-cuts were produced on the plane surfaces

Photo 3:
Various items
made for our
dolls' houses.





Photo 4: The two-section ladder extended to the first floor for cleaning windows.



Photo 5: Stainless metal fixings for the 1:12 scale extending ladder.



Photo 6: The completed 2-section ladder.

at each end of the barley twist to create the plinth and top, with fillets added to smooth the edges of the resulting features.

An STL file was exported from Alibre and sent to my Ultimaker 3 where a print was configured with a 0.15mm layer height and solid fill. Support was added to the overhanging lobes of the barley twist and bowl plate at the top, **photo 8**. After three hours and 24 minutes the print was finished, supports removed and associated scars smoothed away with fine sandpaper before painting with acrylic water-based matt in a mahogany shade of brown.

A matching bowl was again created in software by revolving a 1mm thick cross section and printed using brim support to adhere the narrow base to the Ultimaker's build platform. After cooling, the bowl could be removed and any scars again trimmed and sanded. The bowl was then brush painted in picture framers' gold to leave a distressed brass finish. All that remains now is for

the aspidistra cuttings to take root and our smart tenants can ascend further up their (two-section) social ladder, **photo 9!**

THREE - SECTION EXTENDING TELESCOPE

Dr. S. Mandrel, a celebrated author and editor, lives in our Amersham house, *The Gables* high on a hill above the city smog, with clear views of the night sky. Of a naturally curious character, he has developed an interest in astronomy and intimated a desire to progress beyond his grandfather's mildewed binoculars. Keen to please Dr. Mandrel and thus retain his contributions to my life of indolence, I set about making a telescope to fulfil his celestial ambitions. The result is shown in **photo 10**.

This precision optical instrument is made from three gauges of brass tube, stepped in bore to telescope into each other: K&S Precision Metals and

Albion Metals are manufacturers of this material. Miniature lenses (coated of course!) were turned from acrylic and bonded to the ends of the smaller and larger of the three tubes and tested to ensure compliance with the highest optical standards proscribed by Zeiss. In full-size extending telescopes each tube is swaged at the ends to form lips that constrain the maximum extension, but replicating this micro-scale engineering presented a problem at 1:12 reduction. The solution came during my monthly bath when fresh ideas germinate in my cerebellum: simply fit a thin cord inside the 'scope with the ends glued near the two lenses such that the cord becomes taut when the 'scope is at maximum extension. That way the sections remain connected and the instrument does not fall apart.

Dr. Mandrel attaches a tiny bellows film camera to the objective lens of his telescope to capture remarkable images of the universe. Examples can be seen on his website, stubmandrel.co.uk.

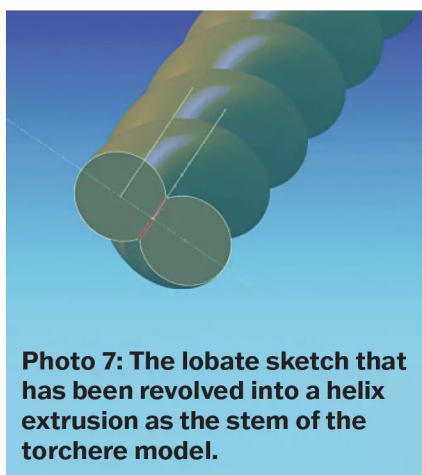


Photo 7: The lobate sketch that has been revolved into a helix extrusion as the stem of the torchere model.

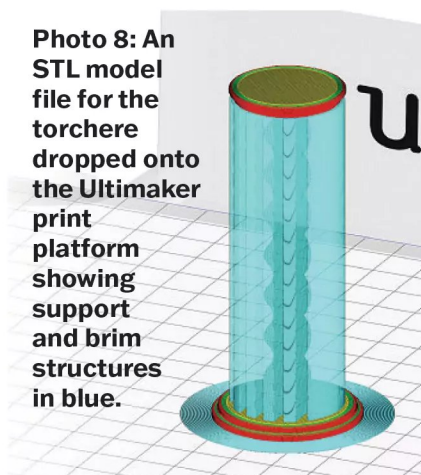


Photo 8: An STL model file for the torchere dropped onto the Ultimaker print platform showing support and brim structures in blue.

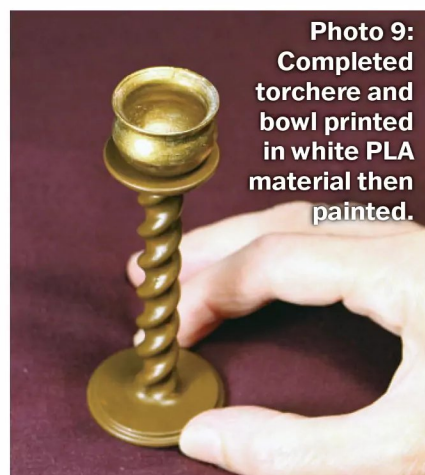


Photo 9: Completed torchere and bowl printed in white PLA material then painted.

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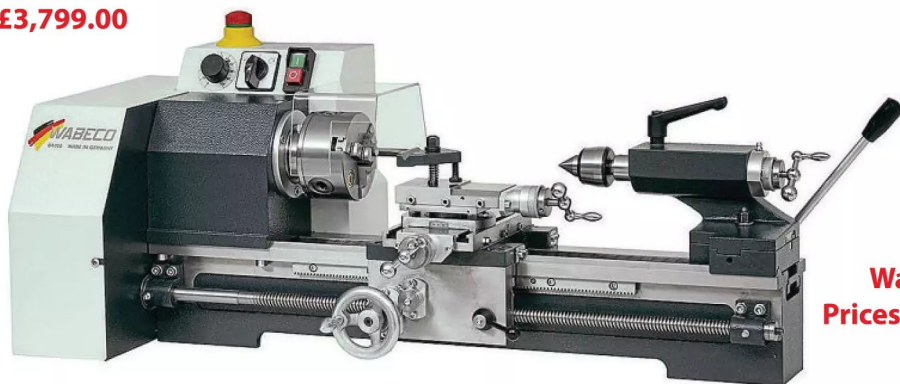
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Photo 11:
Butterfly dome
and net used by
the Reverend
Neversin.



Photo 12: Power
nibbler that fits
into the chuck of
an electric drill.



BUTTERFLY DOME AND NET

A vicar, the Reverend George Neversin, lives in our Romside house situated beside meadows spangled with butterflies. Our Lord seemingly has little call on his time which is otherwise spent gathering the more colourful lepidoptera that he crucifies on cork boards in his panelled study. He is blessed with time but toils under the penance of poverty and cannot therefore purchase the most desired ornament of the day, namely a butterfly dome in which to display his flitting haul. I therefore set about making one in the expectation of a curtailed stay in Purgatory as my just reward.

In the end this project turned out to be a more challenging than expected, since I did not want to base the dome on one of the commercial acrylic mouldings which are out of scale, thick-walled and tapered. After all, period items were delicately hand blown and often oval in section, something that is tricky or impossible to reproduce in miniature.

It was while browsing our local hardware store that I had a light bulb moment in the light bulb department! The ideal component was found as a microwave oven bulb with a cylindrical glass 24mm in diameter and 50mm long, which was exactly to the 1:12 scale for the project in mind. I bought a pack of two and set about removing the screwed metal base with a water-cooled tile cutter. However, no sooner had the blade entered the glass and the vacuum been released than the glass shattered, the same happening

Photo 10:
Extending
astronomical
telescope
supplied to
Dr. Mandrel.



Photo 13:
Stepped cone
drill being used
to create a pilot
hole in the wall
of the tea pot
in readiness for
the nibbler.





Photo 14: Power nibbler in the process of creating the aperture in the tea pot. Notice the liberal use of cutting oil.



Photo 15: Nibbling the hole leaves a pile of disc shaped cuttings that are very sharp!



Photo 16: The first stage in cleaning up the edges of the hole by cross and draw filing.



Photo 17: Finally, the inside and outside edges are cleaned of all burrs to make the pot safe to handle.

Photo 18: Another example of how a diorama can be created in a small container, this time in a watering can. Note the use of slotted nylon cord to protect the sharp edges.



with the second bulb in the pack, despite still greater care being taken. Another double-pack was bought but the same happened and so I returned to the shop to clear the shelf of all remaining microwave bulbs muttering an excuse that the mains voltage in my workshop must somehow be kilovolts above the 230V norm to trigger this calamity.

Another month and another bath brought another light bulb moment! I realised that the glass must contain unannealed stresses resulting from the rapid cooling during the blow moulding process. The solution was to wind a 3mm wide x 3mm thick ring of carbon fibre composite at the base of the bulb above the circumference where the cut was to be made. The idea is that this ring would prevent stress fields in the glass from spreading beyond the ring. Success! The bulb was cut without incident, resulting in a perfect, thin-walled miniature dome, the base of which was the composite

Photo 19: Inside of the teapot has been painted and railway grass added on a plinth to prepare for the Hatter's party scene.



Photo 20: Side view of the completed Mad Hatter's Tea Party.

ring left in place.

A base for the dome was turned from a piece of fine-grained scrap mahogany with a recess to accommodate and conceal the composite ring. A disc of PVC was also turned to form a plinth inside the dome, flush with the top of the mahogany base, and topped with coarse green sandpaper of the type used by joiners and this accurately mimics lawn grass. A 1mm thick disc of plastic, covered with felt, finally closes the assembly. For the interior planting I chose woodsage (which closely resembles foxgloves in miniature) which, once dried, was carefully painted in red and yellow acrylic to match the living flowers.

The Internet provided many images of common British butterflies. One of these free JPG files was scaled in Word and printed at high resolution on a laser copier and the insects carefully cut out with a scalpel under

a strong lens. An assortment of these butterflies was glued to the woodsage flowers before parts for the dome were brought together as shown in **photo 11**. A few minutes work with brass wire, fine net and shrink sleeve also produced a 1:12 butterfly net for the vicar to wave about in the meadows.

THE MAD HATTER'S TEA PARTY (WITH SUE COOKE)

Lewis Carroll was famous for infusing his tales with unfathomable riddles and the Mad Hatter's Tea Party is a charming scene from the seventh chapter. In it the Hatter tells Alice that both he and the Hare are always having tea, with Carroll describing the scene:

"The table was a large one, but the three were all crowded together at one corner of it: 'No room! No room!'

they cried out when they saw Alice coming. 'There's plenty of room!' said Alice indignantly, and she sat down in a large arm-chair at one end of the table..."

In our recreation there is even less room for the Mouse, the Hare and the Hatter, because we set out to model the party at 1:12 scale inside a teapot! The project combined art and craft work by friend Sue with basic metalworking by myself.

An eight-pint aluminium teapot was bought from eBay and the shape for a side opening marked out with a Flexi-curve. The hole could have been cut by chain drilling followed by hacksawing - a rather tedious method even in soft aluminium. Instead the cut was made using a nibbler fitted to a power drill, entering an initial pilot hole made with a cone drill, **photos 12 and 13**. Once complete, the edges of the opening were filed and de-burred to match the shape previously marked as seen in **photos 14 to 17**. If a similar project is being undertaken in thin tinplate such as our 'shed' in a watering can, **photo 18**, then it makes sense to fit a safety edging band of braided cord slotted with a soldering iron.

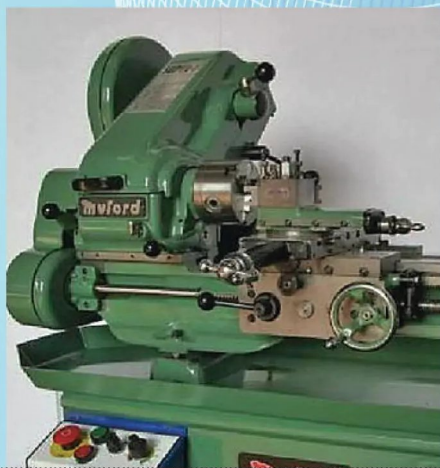
The inner surface of the teapot was roughened to provide a key, then sky and clouds painted with matt acrylics as seen in **photo 19**. The picnic 'lawn' was created by fixing railway grass paper to a circle of mount board and 1:12 scale table and chairs, food and crockery sourced from our local model shop. Alice, the rabbit and all their clothes were made by Sue, together with a miniature Alice in Wonderland book from which Alice is reading as seen in **photos 20 and 21**!

I hope that this article has described the fun to be had in crafting miniature objects, none of which require a major investment in time or resources and yet which will surely delight both tiny people and life-sized humans! ●

Photo 21: Top view of the Mad Hatter's Tea Party.



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Photo 42: Boring a hole to depth.

In this instalment of our beginner's series, **Neil Raine** looks at using the lathe for boring holes.

Working on the Lathe: Drilling and Boring

PART 6

Little has yet been said about using the lathe for boring. Once the component has been drilled on the lathe the opening can be widened using a bore cutting tool. The lathe excels when a component needs to be precisely bored to a depth or completely through, but the versatility of using the lathe for boring extends deeper still. The tools used for boring on the lathe can be attached directly

to the lathe spindle and rotated, held stationary in the tool post or the tailstock or positioned within a long bar held between centres driven using a lathe carrier and catch plate, refs 2 and 3. Mounting the work in a jaw chuck or faceplate on the lathe spindle for boring is done according to usual convention. If the component is an irregular shape, it must be balanced to eliminate vibration when it is rotated.

With the top slide removed, the cross slide becomes a slotted boring table that moves precisely in the Z axis and X axis. The addition of a vertical milling slide increases versatility further still. It is difficult to find a better example of one cutting operation to better celebrate the versatility of the lathe; only a few examples can be mentioned here. The choice of the method used mostly depends upon the size and the shape of the component. The greatest limitation to boring on the lathe is the capacity of the swing over the bed.

THE BORING BAR

Essentially, the boring bar is a lathe turning tool that is designed to cut on the inner concave surface, rather than the outer convex surface, of a cylinder, **photo 42**. Yet, until the drill bit has done its work, the boring bar is effectively redundant as it cannot start the bore, only enlarge it. The boring bar is a single point cutting tool that will precisely widen a bore to a specific dimension. Using a boring bar to finalise the dimension of a bore can provide greater precision than either a

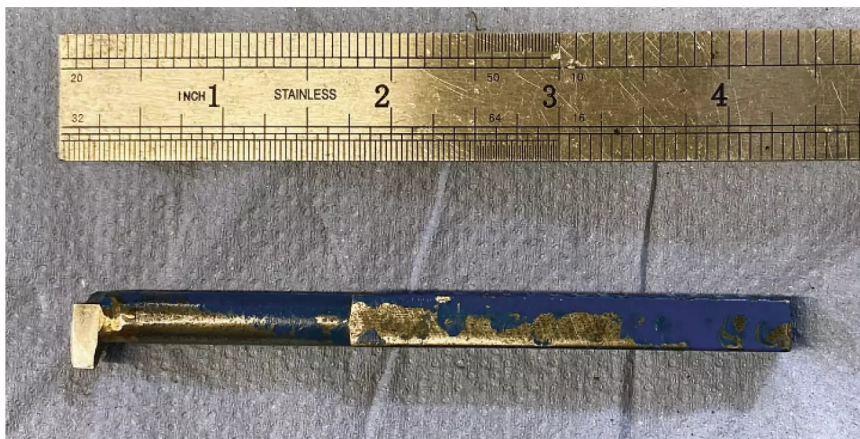
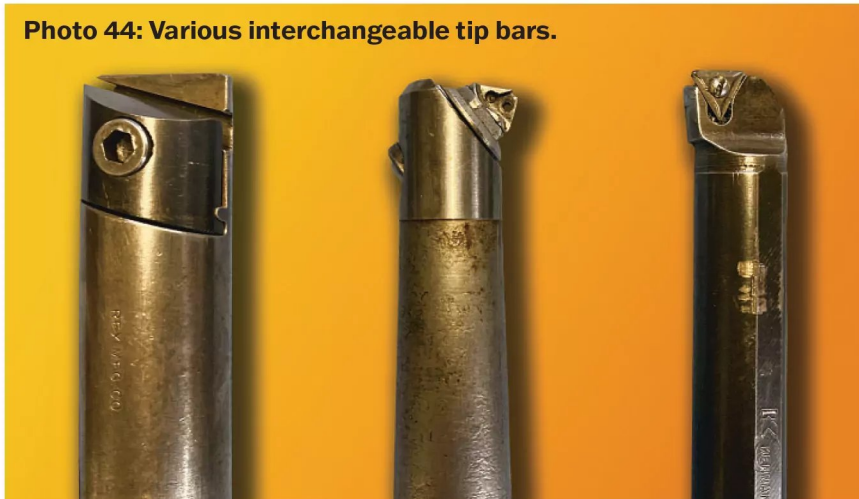


Photo 43: Brazed carbide boring bar.

Photo 44: Various interchangeable tip bars.



drill bit or a reamer. The other advantage is the bore may be enlarged to any arbitrary size.

The cutting edge or cutting tip of the boring bar is shaped or ground into a cutting edge from solid bar material (usually carbon steel or HSS), or, it is attached to the tip of the boring bar either by brazing, **photo 43**, or as an interchangeable carbide insert (see **photo 45**, later). When the boring bar is ground from one piece of HSS, or an HSS tip is brazed into place, the cutter

is a tooth-like projection that sits proud of the main shank of the tool to provide lateral clearance for it. The complete head of some boring bars is interchangeable, **photo 44**. This enables the angle of the cutter to be changed, for example, to cut an internal groove such as that required to locate an oil seal. The design and operation of the boring bar is discussed in more detail later.

Typical of a boring bar is a circular cross section that is sympathetic

to the round bore of the part that is machined. The precise cross-section does vary between different boring bars. Whereas some tools are perfectly circular others are circular with a flat top or circular with a flat bottom. Because of these differences, boring bars are secured to the lathe tool post in different ways. Dedicated tool holders for a quick-change tool post are either vee-shaped or are bored to accept a cylindrical boring bar. Some traditional style boring bars have a square shank to secure them directly to a tool post; the bar itself, however, is usually round. The size of boring bars varies from a few millimetres in diameter up to a metre or more long. Engineers sometimes make their own boring bars, especially larger ones.

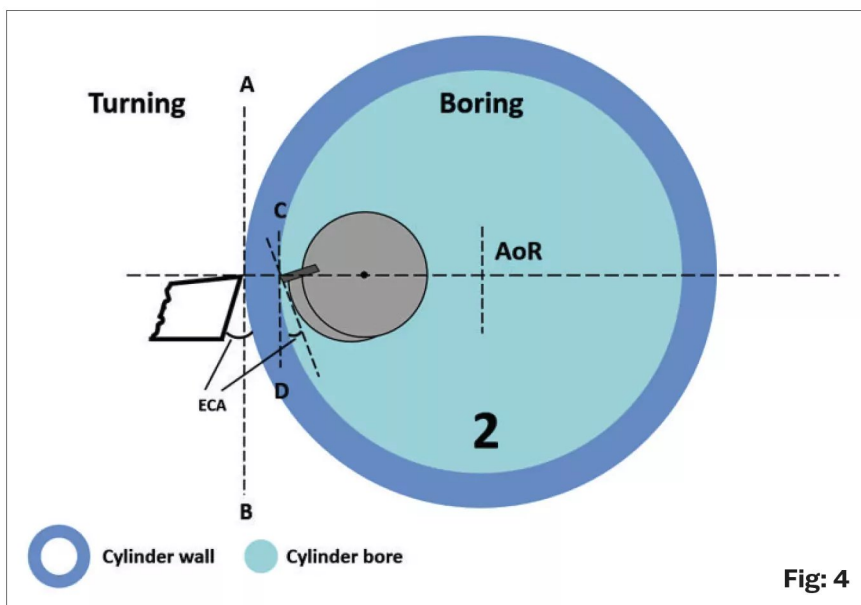
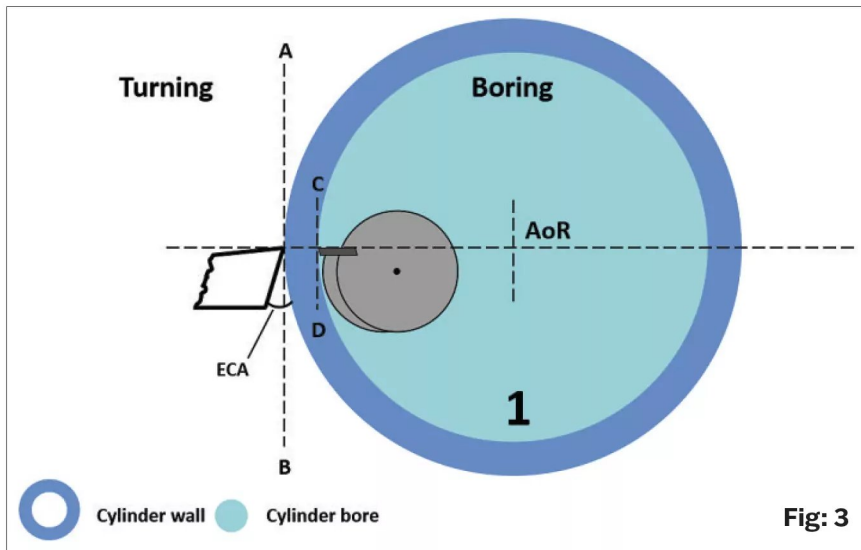
In use, the boring bar is aligned parallel to both the rotational axis of the lathe and the bore of the component, **photo 45**. To set the tool correctly, the tool post is aligned square to the machined face of the lathe chuck or faceplate and the cutting edge of the boring bar is positioned exactly at centre height. The boring bar is fed into the work along the Z axis using either manual or powered feed. Conveniently, on the lathe the cross slide may be used to precisely position the boring bar with respect to radius of cut. Opposite to conventional turning, the cross slide is moved toward the operator to increase the depth of cut and enlarge the bore. Furthermore, by setting the top slide of the lathe to an angle, a boring bar can be used to cut an internal taper. Ideally power feed is used to ensure the best finish when boring, but this is usually not possible with an angled topslide.

There is usually a need to extend the boring bar deep within the bore beyond the support of the tool post and this affects its cutting performance. The distance between the cutting edge of the boring bar and the end point of support on the tool holder is known as tool overhang or stick out, **photo 46**. Tool overhang negatively affects rigidity of the tool and increases the likelihood of vibration and chatter. Some engineers adopt a maximum seven to one rule for the ratio of tool overhang to the diameter of the boring bar. As the bore is widened, changing the boring bar to a larger one will improve rigidity and can offset the complication of vibration and chatter if present. However, the diameter of the boring bar is limited by the size of the bore.

Flexing, springing or deflection of the boring bar under loading, with or without noticeable vibration, can also affect cutting performance. If the tool is not retracted before removal, it will



Photo 45: Typical boring setup.



often be noticed that the boring bar cuts on its return path as well as the forward cut. This is evidence that the tool is flexing and is cutting an undersized bore. As many boring tools do not cut well in reverse, ideally the bore should be measured after the initial cut and, unless it is to dimension, a second spring pass is taken at the original setting to recut the bore to the intended dimension, ref. 28.

DESIGN AND FUNCTION OF THE BORING BAR

The tools described here are classified as single point cutting tools. The position of the cutting edge relative to the work is very important when turning on the lathe. When the cutting edge of the tool is aligned exactly with the axis of rotation (AoR) and

is perpendicular to the cylinder, the clearance angle and the rake angle ground onto the tool work as intended. When the turning tool and the boring bar are perfectly aligned with the AoR outside and inside the cylinder, respectively, they should theoretically cut in an identical manner. Figure 3 shows the alignment of a conventional turning tool and a boring bar with respect to the cylinder. The views of the tools are turning tool, left side of a right hand tool; and boring tool - end of the tool. The conventional turning tool is orientated perpendicular to the cylinder wall; the boring bar is aligned parallel to it, longitudinally. The difference in orientation accounts for the contrasting position of the cutting edge - left face for a conventional right hand turning tool and on the front face of the boring bar. The heel of each cutting tool is positioned below the cutting edge. For



Photo 46: Demonstrating overhang with an inserted carbide tool.

the conventional turning tool that cuts onto the convex surface of the cylinder, when the tool height is set correctly this is of no consequence. The convex arc of the cylinder leads away from the tool and the dotted line A B (tangent). This increases clearance for the tool below the cutting edge, i.e. the effective clearance angle (ECA) is greater than the clearance angle ground onto the tool.

The same is not true for the example boring bar as it cuts onto the concave surface of the cylinder. The side clearance angle of the carbide insert shown relative to the dotted line C D (tangent) is effectively negated by the concave shape of the cylinder wall that comes around to meet the tool. With the boring bar in this (incorrect) orientation, the heel of the tool is virtually in contact with the cylinder wall and the tool is unable to cut. To remedy this problem, manufacturers of boring bars design them with some subtle attributes to enable them to cut on the inside of a cylinder wall.

The boring bar shown in **photo 46** (Kennametal B1505) has a diameter of 15 mm and is 250 mm long. When the head of a boring bar is examined, there are a number of features that allow clearance for the boring bar inside the cylinder and enable it to cut effectively. Viewed from above and from beneath, the head of the boring bar is slightly widened to the right side (2.0 mm offset) and has a slight taper running from front to back, **photos 47** and **48**. Viewed directly end on, **photo 49**, and from the side, **photo 50**, the head of



Photo 47: Tip of the inserted carbide tool.



Photo 48: Below the tip of the insert tool.

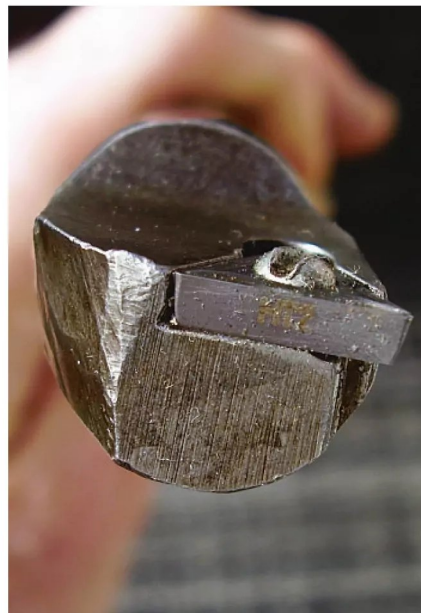


Photo 49: End on view of insert tool, rotated six degrees for clearance.

the boring bar has a depth of 10 mm compared to a diameter of 15 mm for the remainder of the bar. The flattened upper surface of the head that houses the cutter, the plateau, is angled left to right and back to front.

The boring bar shown was not designed to be positioned as in **fig. 3**. It is designed with the head rotated approximately 6 degrees clockwise. When the boring bar is set to the correct height, all three elements - the top of the cutter, the centre of the boring bar and the AoR of the cylinder - are in horizontal alignment, **fig. 4**. In doing so, vitally, the heel of the tool is directed away from the cylinder wall creating a clearance angle that enables the tool to cut. The clearance angle is shown by the appearance of a light blue triangle between the tool and the cylinder wall, the effective clearance angle (ECA). The smallest distance between

the cylinder wall and the heel of the boring bar is equivalent to the maximum depth of cut the boring bar can take. Therefore, the cylinder must be bored to dimension progressively using a shallow depth of cut. In contrast to the design described above, the head of some boring bars is skewed anticlockwise (yaw), rather than displaced laterally, to achieve the same aim.

The rotation of the boring bar is designed into many boring bars with flat upper and/or lower surfaces. Boring bars with cylindrical shanks must be rotated by the user.

One way the cutting edge of the boring bar can be orientated horizontally is if the cutter is moved laterally beyond the perimeter of the tool, as per the tool in **photo 43**. However, this can reduce the support directly beneath the cutting edge, weakening the tool. Boring tools that do not use

carbide inserts often have ends that bend outwards or are ground to such a shape, with extra clearance ground below the cutting edge.

If the diameter of the bore is wide enough, the clearance angle can be further increased, temporarily, by rotating the tool post anticlockwise to present the boring bar at a slight angle. This will allow a deeper cut to be taken. The limitation is as the bore deepens and the boring bar is introduced further, it will eventually foul against the far side of the bore.

BETWEEN CENTRES LINE BORING

Another method used to bore a cylinder on the lathe is quite different from that just described. Whereas the boring bar can be used to enlarge a through or blind bore, line boring can only be used to enlarge a through bore. In a line boring setup, the boring bar is held between centres in the lathe and is rotated inside the component, **ref. 2**. The cutting tool is usually socketed into the boring bar near to the midpoint. Otherwise, the tool may be mounted in a circular tool holder that is clamped around the circumference of the boring bar. The component is mounted onto the machined surface of the cross slide and must be precisely centred to the bar before cutting begins. Powered feed of the lathe carriage is often used to provide linear movement of the component relative to the boring bar.

To be continued



Photo 50: The tip is angled down to increase front clearance.

The Stationary Steam Engine

PART 68 Technical Details of the Newcastle Locomotive

Ron Fitzgerald concludes his sweeping and thoroughly researched story of the development of the stationary steam engine with a review of the facts we know about the Newcastle Locomotive.

Shorn of anecdote, the facts that emerge from the accounts of the Newcastle locomotive can be summarised. Christopher Blackett, the putative customer for the locomotive, was part of a collateral line of descent from the Blackett coal and lead dynasty which had risen to eminence in the Newcastle trade after the Restoration. The main family coal holdings were on the south side of the Tyne, in Gateshead, at Winlaton and the Stella Grand Lease. Christopher Blackett's interests however were north of the river, at Wylam, the furthest western limit of the coalfield. The main pits were Wylam Hough, Peggy and Anne which began working in 1748, all mined under the river itself. The nearest point accessible to river keels was Lemington, five miles downstream and a wooden waggonway was laid from the pits to the Staithes at that point.

Unlike the majority of Newcastle waggonways, the Wylam line was virtually level for its entire length. This permitted the employment of the largest capacity waggons in use in the area, 53 cwt (about 2.7 tonnes) and it was also a rare instance of hauling the waggons in pairs. Against this, Wylam did not benefit from the advantage of a falling gradient which elsewhere facilitated gravity-assisted free running of the laden coal waggons. This may have been a factor in attracting Blackett to the possibility of steam locomotive haulage, although whether he approached Whinfield or Whinfield approached Blackett is unclear. The precise nature of the contractual relationship remains obscure and there is nothing so far found in the surviving Blackett papers to indicate that any money changed hands. The balance of probability suggests that Whinfield was prepared to hazard a speculation in building the machine. Interestingly, neither Blackett nor Whinfield are mentioned in the various patent royalty papers discussed in a previous part of this series.

The two ink-on-paper drawings, discussed in the previous instalments, are dated September and October 1804 and, on 10 January 1805, Trevithick writes from Whitehead and Company's Soho Iron Works in Manchester:

... I expect some of the travelling

engines are at work in Newcastle ...

Robert Wilson's note indicates that he saw the engine on 1 May 1805 and the impression that he gives is that it was complete. John Turnbull could not be precise, but he evidently witnessed the machine running up and down on a temporary line of rails laid within the Pipewellgate foundry's premises:

...to let the quality see her run...

Although the performance seems to have been satisfactory:

....there was some disagreeency (sic) between (Blackett) and the master...

Blackett declined to accept delivery and the engine was taken into the foundry to be used to power set of a furnace blowing bellows where it was seen by George Bold. Bold's visit is not dated but it must have been after Wilson's visit in May 1805, as Wilson was then still under the impression that it was intended to work on the Wylam waggonway.

The technical specification of the engine is reasonably well attested from the drawings and descriptions. If the Pen-y-darren locomotive is taken as a larger-size replica of the machine shown in the Llewellyn drawing, then the Newcastle locomotive perpetuates the general physiognomy of the Trevithick high-pressure cast iron boiler with its internal U-tube furnace and flue. It differs from the known stationary engines in that the cylinder was immersed horizontally into the boiler shell with the advantage that the internal, U-shaped flue could extend for the full length of the boiler, unobstructed by the cylinder, thereby increasing the heating surface, **ref. 385**. The horizontal cylinder also removed the restriction that the boiler diameter imposed on the stroke length which may account for the exceptionally long stroke of these locomotive engines compared to the stationary engines listed in Farey's table. The Pen-y-darren locomotive's eight inches bore cylinder has a 54 inches stroke where Farey suggests 42 inches might be expected in a stationary engine. The Newcastle locomotive has a 42 inches stroke compared to the 36 inches commended by Farey for a 7 inch cylinder.

Compared to the Welsh locomotive, the Newcastle machine has its cylinder

repositioned to the opposite end of the boiler barrel and the crankshaft and flywheel have correspondingly been transferred to the chimney end, improving access to the firedoor. Power transmission to the wheels is again by a single gear train mounted on one side of the locomotive only. A first motion gear on the crankshaft drives to a larger diameter idler wheel carried by a stub axle on the boiler side and this gear engages with two gears respectively attached to the running wheels. The arrangement is shown on both the wash drawing of the Newcastle locomotive and on the ink line drawing, but the gear ratios appear to be different between the two illustrations.

The illustrations of both the Pen-y-darren locomotive and the Llewellyn drawing show the boiler shell as a single casting, **ref. 386**. It has been suggested that the Newcastle locomotive has its boiler barrel cast in three rings, **ref. 387**, but this appears to be a misrepresentation of the customary practice of moulding strengthening rings onto the exterior of hollow cylindrical castings. These rings are shown as flat strips on the wash drawing but are more correctly depicted on the line drawing with the characteristic, semi-circular profile, raised annulus. The cylinder end of the boiler was dished and cast integrally with the shell including the cylinder mounting socket and flange. The closure plate at the opposite end of the boiler was a separate, flat disc casting with plummer bearings cast in to take the crankshaft. It was flange bolted to the shell. The wash drawing seems to suggest that there was a rectangular belly tank under the boiler possibly for water although this is not shown on the ink drawing. There is no obvious sign of a boiler feed pump.

As had become the accepted practice, the cylinder valve chest was attached to the externally exposed end of the cylinder and the valve port to the opposite end of the cylinder, although not visible on any of the drawings, can be assumed to have been carried down the outside of the cylinder wall to an inlet opening into the cylinder base. The valve cock body casting, as shown on the drawing *Regulating and Throttle cocks for Engine No. 1*, contains two plug valves,

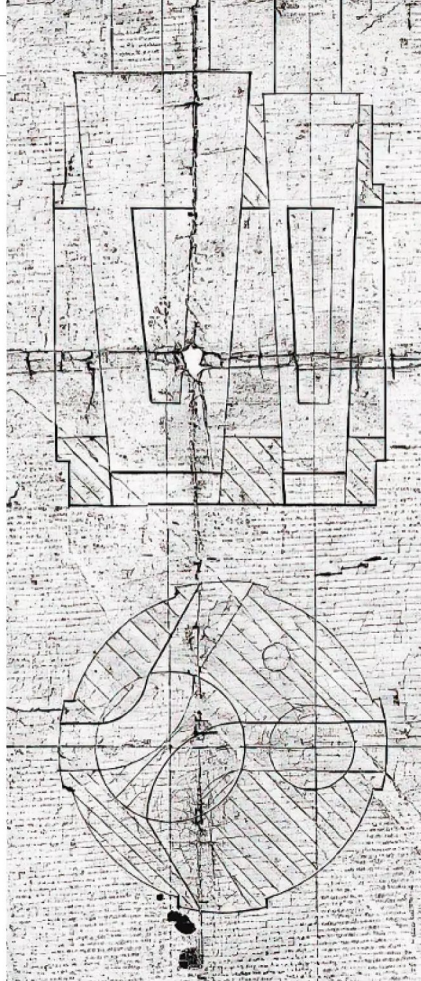


Fig. 214 Detail of the body casting and plug valves.

the smaller one controlling the steam supply from the boiler and the larger one communicating with the cylinder ports, **figs 214, 215 and 216.**

Neither of the side elevation drawings gives a total picture of the valves and valve gear. The valve gear is more complete in the wash drawing, a bent arm attached to the connecting rod trips a valve spindle lever, but the representation of the valve chest differs from that shown on the ink on paper drawing. The latter appears to relate more closely to the regulating and throttle cock drawing, but the valve stems and spindles are not shown. A transfer pipe attached to the side of the valve chest is included in this drawing which may be for the purpose of the inlet steamway from the boiler, or it may be the outer end of the port communicating with the opposite end of the cylinder. Neither drawing includes the connection which opens and closed the throttle valve nor that which reciprocated the plug valve.

The other principal difference between the Welsh machines and the Newcastle version lies in the fact that one was designed to run on a plateway whilst the other was intended to run an edge rail system. It is thus justifiable to regard the Newcastle locomotive as the first railway locomotive to employ flanged wheels.

Table of dimensions for the Pen-y-darren locomotive, the Llewellyn drawing and the Newcastle Locomotive.

	Pen-y-darren.	Llewellyn drawing	Newcastle
Edgerail/platerail gauge.	4' 4" ^{a1}		5' 00"/4' 10" ^b
Dist. between wheels	4' 6" ^{a2}	3' 00"	
Cylinder bore	8¼"	4¾"	7" ^c
Cylinder stroke	4' 6"	3' 00"	3' 00"
Wheel diameter	2' 10" ^d	2' 11"/ 3' 00"	3' 1"/3' 3"
Wheelbase		3' 00"	4' 8 ½ "
Boiler diameter	4' 3"	2' 11"/ 3' 00"	4' 00"
Boiler length.	6' 00"	4' 00"	6' 6"
Boiler wall thickness.	1½"	N.a.	1½"
Engine weight.	5 tons		4½
H.P.	10.5 ^e	2.3 ^e	8.9/4. 00 ^g

Notes for the table

The sizes given for the Pen-y-darren machine are based upon Francis Trevithick's Life and Farey's Treatise.

a1. M.J.T. Lewis. *Steam on the Pen-y-darren*. *Industrial Railway Record*. No. 59. April 1975. P. 14.

a2. Gordon Rattenbury and M.J.T. Lewis. *Merthyr Tydfil Tramroads and their Locomotives*. Pub. Railway and Canal Historical Society. 2004. P. 53.

b. Some sources state the gauge to be 5' 00" but Trevithick's Life says 4' 10" which is the figure taken by M.J.T. Lewis in his various publications.

c. Francis Trevithick Life gives 8" for the cylinder diameter whereas Dendy Marshall in his *History of Railway Locomotives down to the end of the year 1831* scaled the cylinder size to 9 inches. Taylor and Bass say 8" diameter. Wilson's dimension is adopted here as it is contemporary with the locomotive. All authorities are agreed that the stroke was 3 feet.

d. M.J.T. Lewis. *Steam on the Pen-y-darren* *ibid*. p.12.

e. M.J.T. Lewis. *Steam on the Sirhowy Tramroad and its Neighbours*. 2020. Pub. Railway and Canal Historical Society. 2004. P. 47. Fn. 10. Lewis quotes a formula derived by Jennifer Protheroe-Jones. Note by present author: the boiler pressure assumed by Lewis is 40 p.s.i. whereas Trevithick seems to have favoured 50 p.s.i. Pressure drop between boiler and cylinder is unlikely to have been as much as 50% as the there was no prolonged exposed steam pipe connection and with the cylinder immersed in the boiler the two components would be at virtually the same temperature. There may not have been any cut-off at this time.

f. By Lewis/Protheroe-Jones formula and piston speed of 192½ feet per minute.

g. Table reproduced in previous episode 61 of this series based upon Farey. *Model Engineer* Issue 4751, 6 - 9 September 2024.

The table compares the main dimensions of the three locomotives. The Llewellyn drawing shows a machine which is much smaller than the other two and whilst the Newcastle locomotive is nearer in size to the Pen-y-darren locomotive, it is also smaller. The cylinders of the Welsh locomotive had a cubic capacity of 2,887 inches whereas the Newcastle engine had 1,385.6 cubic inches, a reduction of 52%. The boilers are only marginally different in capacity despite the dimensional disparity, 85 cubic feet for the Pen-y-darren locomotive and 81 cubic feet for the Newcastle one, a reduction of 4.75%.

The question remains, to what extent was Trevithick personally responsible for the design and construction of these machines. Trevithick was, of course, trained as a mine surveyor and his competence in conveying information onto paper would be accordingly

developed in this area. Even so, physical evidence of his design and drawing office ability is sparse. Only the drawing of the Bull pumping engine has been ascribed to his penmanship, **ref 388**. Certainly, the Bull engine drawing is an accomplished example of a wash drawing and it would be useful to compare the technique used in the wash drawing of the Newcastle engine with this earlier example of his work. As far as the two ink-on-paper drawings are concerned, as it stands at present, the authorship is attributed to Trevithick by assumption alone. The best that can be offered in the absence of specialist assessment is a comparison of the handwriting on the drawings. A very cursory and by no means professional comparison with two known and published examples of Trevithick's script in Dickinson and Titley, **ref. 389**, shows virtually no similarities.

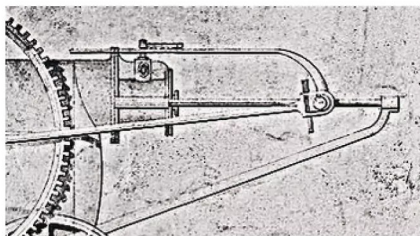


Fig. 215 Wash drawing detail of valve chest.

At this point it is worth recalling the means by which the drawings are said to have arrived at Whinfield's Pipewellgate foundry. The Naylor and Bass notice pasted onto the wash drawing specifically says:

John Steel...turned his back on Wales and brought with him the drawings...

Bass was writing in 1870. None of the earlier sources are explicit on this matter and whence Bass obtained the information is unknown. It is implied by Bass that the drawings were used by Whinfield's patternmaker, William Tomlinson.

In view of Steele's pivotal role, it is worth examining his career more closely. John Steele (variously spelt Steel) was born at the Pontop Colliery, Moor Pit. His father had been a coachman who later became a brakesman on the Pontop Railway. It was here that the child suffered an accident that resulted in his leg being crushed. Amputation followed at the Newcastle Infirmary and in the face of considerable odds, he survived this horrendous trauma, thereafter sporting a wooden leg. The accident appears to have happened after he started school at the nearby Colliery Dykes but this notwithstanding, he was clearly both intellectually and practically precocious. It is recorded that his tutor... could never set him fast in figures... and that he was also an ingenious model maker leading his schoolfellows... to marvel at the correctness of his imitations of pit engines...

His disability did not debar him from commencing an apprenticeship as a millwright on the Pontop Railway although he subsequently transferred his indentures to John Whinfield. Here, he apparently met Trevithick who attempted to attract him away to Cornwall. Steele declined the offer but upon completing his indentures at Gateshead he joined Trevithick at Homfray's works in South Wales where he participated in the construction of the Pen-y-darren locomotive. As this locomotive first ran in February and March 1804, Steele's presence in Wales must have been before that date.

Whether Steele moved back north at the behest of Whinfield and or whether he remained in Trevithick's employment whilst at the Pipewellgate foundry is unknown. He is variously referred to as

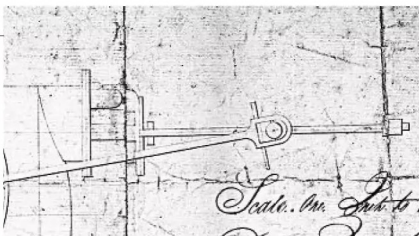


Fig. 216 Ink on paper drawing detail of valve chest.

Whinfield's engineer (Wylie and Henderson) and Turnbull was of the opinion that he was:

...The engineer... who was regularly employed at the works 'and a very clever fellow'...

Bass, whose knowledge was second-hand, calls Steele Whinfield's... foreman... but this must be taken as a loose term. Whatever the exact status that he occupied, all accounts concede that he was central to the construction of the locomotive. When speaking to his old schoolmate George Bold, Steele obviously felt some sense of proprietorship over the locomotive, asking Bold whether he had seen... the iron horse that he had made...?

After the venture in Newcastle was abandoned, Steele returned to or possibly continued in his association with Trevithick. In 1808 he was in charge of Trevithick's London tank building workshops and being paid (intermittently!) by him. After Trevithick's bankruptcy Steele continued to develop the tank making business but subsequently migrated to France where he established a foundry and machine shop at La Gare near Paris in conjunction with William Aitken. The firm specialised in high-pressure stationary and marine engines and a French patent was taken out in 1820 for a variant upon Woolf's engine.

The completion of Steele's biography is subject to conflicting versions. According to the standard French history of Rhone Navigation, Steele was killed in an explosion which took place at the Pont de la Guillottiere in Lyon on 4 March 1827, involving one of his own boats, *Le Rhone*, **ref. 390**. Additional detail comes from the obituary of John Barnes, **ref.**

391. Barnes recounts the story that Steele was engaged in the fitting *Le Rhone's* engines when he was visited by the eminent engineer Charles Manby, at that time running his own engineering works in France. Manby took his workmen on board *Le Rhone* to assist his countryman preparatory to sea trials. On going below he saw that the engineman had fastened down the safety valve with the avowed intention of ... making her go or bursting her... Manby and his workmen precipitately returned ashore and the boiler followed the second of the two options. Steele was killed along with several important Lyons dignitaries and many spectators on the quays. The incident had a profoundly negative impact on the future of steam navigation in France in the short-term, a situation that according to Barnes' obituary was salvaged when Messrs. Miller and Barnes rescued the reputation of the high-pressure steam marine engine.

Curiously, an anonymous correspondent of the *Gateshead Observer*, writing in October 1858, offers this somewhat different account:

Steele... commenced to make marine engines for the Government of France. Two steamboats he made with oscillating cylinders ... A third was completed but not handed over when he received intelligence of the violent death of his brother-in-law, Nicholas Young, engineer at Fawdon Colliery who was killed in an accident. He responded by starting with the boat on an experimental trip intending to visit England to bring his widowed sister and her child to his own home. His voyage however was brought to a fatal termination. The boat called at some French port... Steele went on shore with a friend and on his return he was informed that something had gone wrong with the safety valve. Leaving his companions in the carriage... he went on board to put the matter right and suddenly the boiler exploded and he and several others were killed...

ME&W

References and footnotes

- 385** There is apparently a drawing held by the West Glamorgan Archives, *Neath Abbey Ironworks Papers*, showing a stationary engine made for the Pen-y-darren Ironworks with horizontal cylinder located at the chimney or firing end of the boiler. This drawing has not been dated. *Early Railways: Some Curiosities and Conundrums*. Andy Guy in *Early Railways 2. Papers from the Second International Early Railways Conference*. 2001. Ed. M.J.T. Lewis Vol. 2, Pub 2003, The Newcomen Society)
- 366** Francis Trevithick... *Life*, p. 182, says the boiler shell was wrought-iron but this can be dismissed.
- 387** *The First Locomotive Engineers*. L. G. Charlton. Northern History Booklet No. 55. Pub. Frank Graham 1974. P. 7)
- 388** *The Early Career of Richard Trevithick II and Edward Bull*. Episode 52. *Model Engineer* Issue 4730. 17 - 30 November, 2023.
- 389** Hologram copies reproduced in *Richard Trevithick, A Memorial Volume*. H. W. Dickinson and A. Titley Pub. Cambridge University Press 1934. Plates facing pages 19 and 63.
- 390** *Vapeurs sur le Rhone Histoire Scientifique et Technique de la Navigation a Vapeur de Lyon a la Mer*. John Marc Combe et Bernard Escudie avec Jaques Payen. Lyons Universitie Press 1991.
- 391** Fn. 394. *Min. Proc. Inst. C.E.* vol. xii. P. 143.

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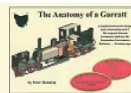
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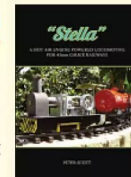
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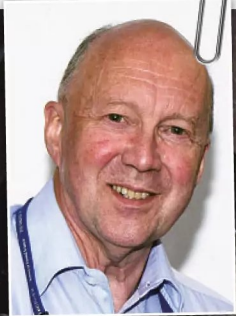
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A Tandem Compound Mill Engine

PART 15

Photo 219: Starting to form the governor head on the end of a piece of rectangular bar.

David Thomas builds Arnold Throp's model of a Corliss mill engine. Continued from Model Engineer & Workshop issue 4763.

At the top end of the governor is the collection of parts, **figs 36** and **37**, that will (if I can ever get them to function properly) control the speed of the engine. At the time of writing the governor spins around, looks the part and can be set to cause the valve gear to trip but

only sits at the full extent of its travel. Further work will have to wait until the rest of the details of the engine are finished. Small governors are always going to be difficult to get to work realistically due to some very non-linear scaling effects.

The governor head is machined on

the end of a stub of rectangular bar. In **photo 219** you can see that I had thinned this to the originally specified thickness of $15/32$ " which was a mistake as the central bore was drawn as $29/64$ " leaving just $1/128$ " each side. Inevitably, that wall thickness allows the sides to bulge with the cutting forces. It's better to use $1/2$ " bar left full thickness for this part. **Photograph 220** shows the last operation with the part attached to the parent bar and **photo 221** the final shaping on the outside of the head. In **photo 222** the central slot is being milled out and the small bulge from drilling out the centre can just be seen.

The spindle was made from free-cutting stainless which I used wherever possible to reduce future maintenance. In **photo 223** it is being roughed out with a very long parting tool. The notch in the end of the tool reduces the cutting forces so that the tool doesn't wander very much. This is a tip I first learned from Len Mason's book on building the Mastiff IC engine where Len recommended it for turning the crankshaft journals. The 14.5 degree internal slope on the last step of the spindle is specified on the original drawings along with a note on the

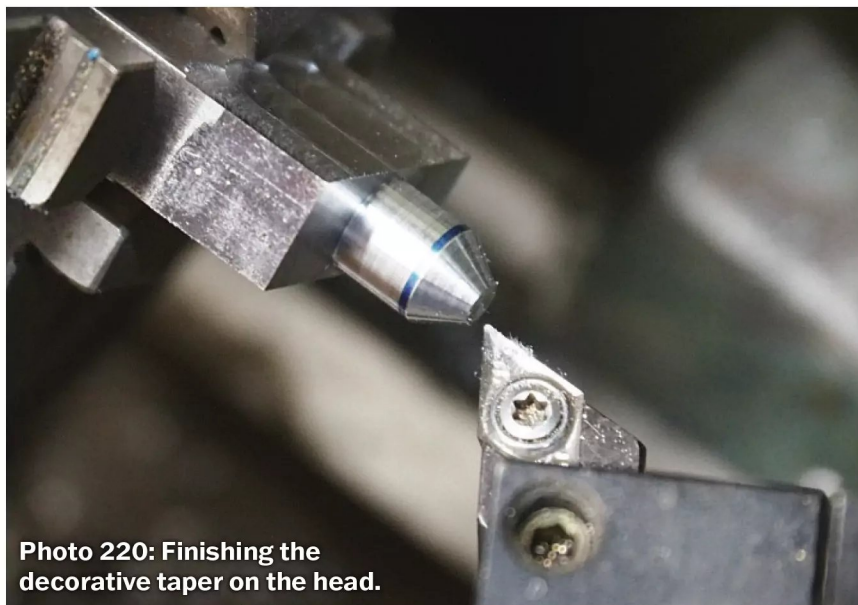


Photo 220: Finishing the decorative taper on the head.

Photo 221: Machining the bevels on the head. The ends have been rounded over using filing buttons.



Photo 222: Cleaning out the internal slot. The part shown has been made to the 15/32" width from the original drawings and shows the damage on the side from using an over-large drill.

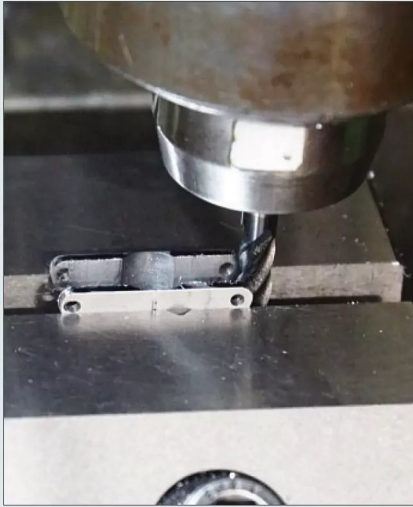
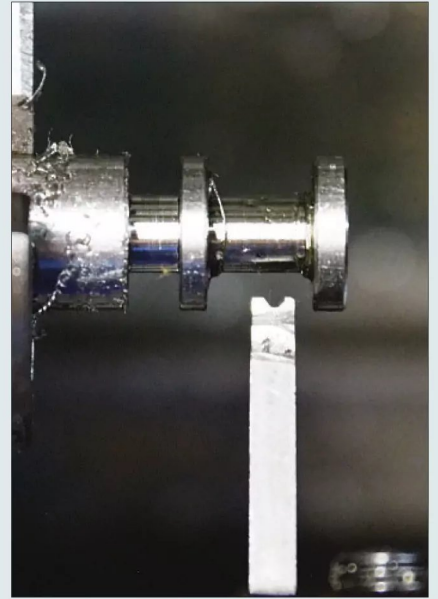


Photo 223: Roughing out the spindle. The divided end on the tool reduces the cutting forces.



weight lever detail that you should 'file to involute' the end that engages with this slope. I've assumed that this is intended to make the surfaces work like one tooth of an involute gear and to minimise friction. **Photograph 224** shows the set-up needed to produce

the slope. The process of carving a weight lever on the end of a bit of bar is shown in **photos 225, 226 and 227**. In **photo 228** I'm using an old involute gear cutter to shape the end of the lever as my chances of filing this shape were very remote. As it is, a

circular cross-section would probably serve just as well. The weight levers need to move smoothly with minimum shake so reamed holes are needed for the fulcrum pins, **photo 229**. **Photographs 230 and 231** show the last operations on a lever and **photo 232**

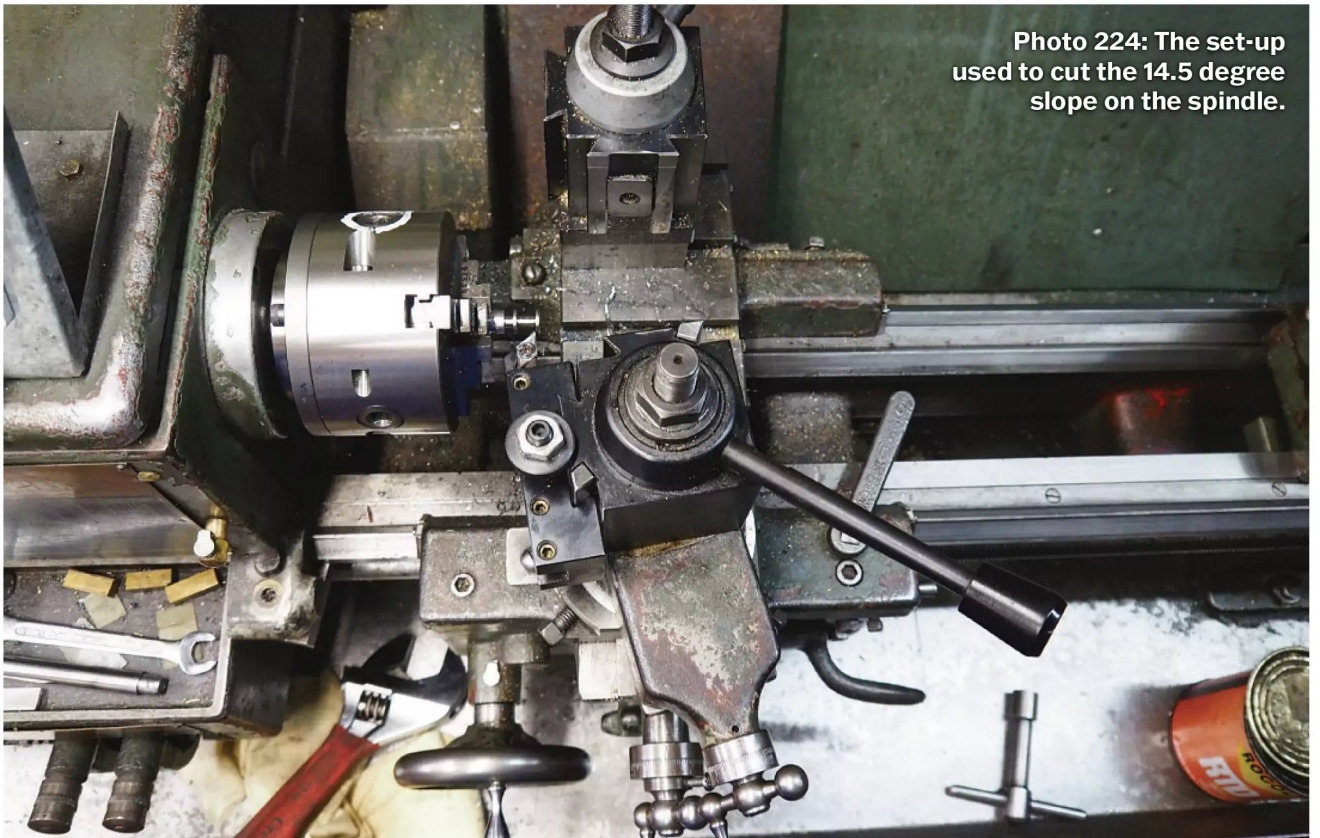


Photo 224: The set-up used to cut the 14.5 degree slope on the spindle.

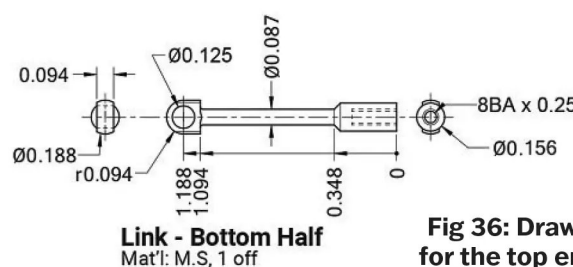
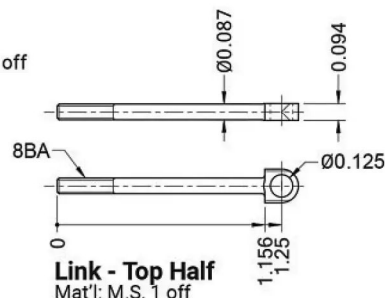
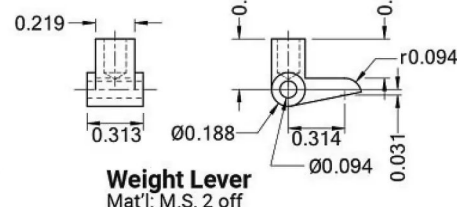
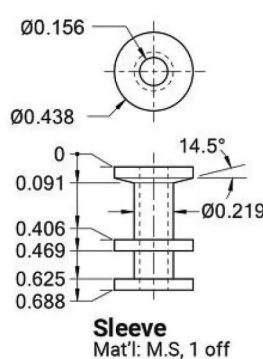
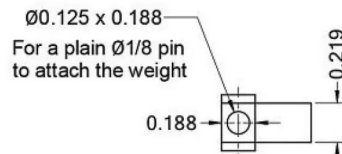
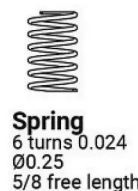
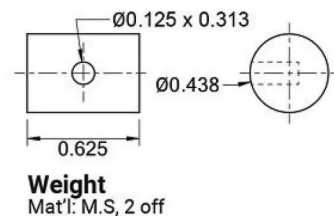
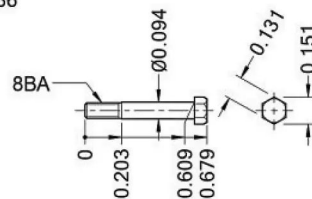
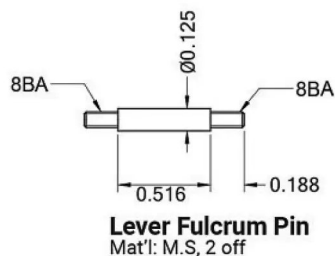
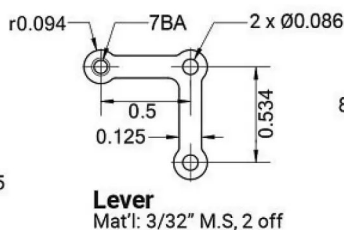
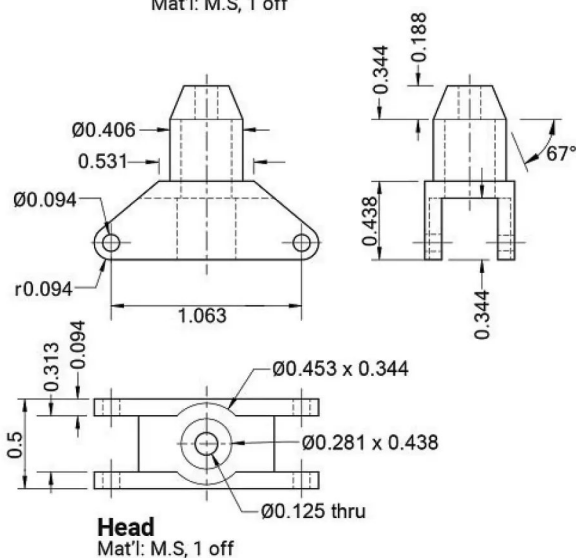
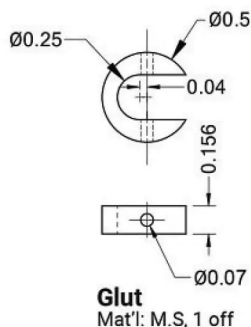
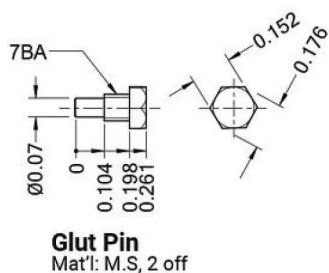
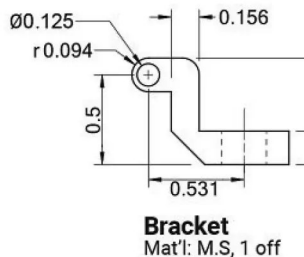
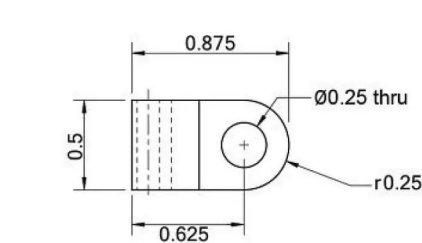


Fig 36: Drawings for the top end of the governor.

Photo 225: The weight levers are formed on the end of a length of rectangular stock.



Photo 226: Drilling for a pin to attach the weight.

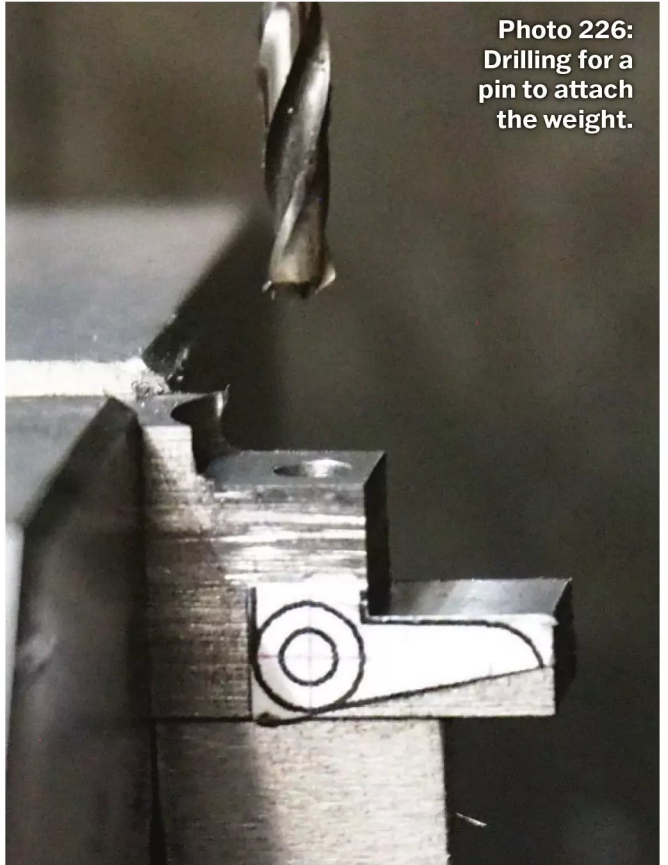


Photo 227: More work on a weight lever.



Photo 228: The original drawings say 'file to an involute' but achieving that seemed unlikely to happen so I used a 14.5 degree gear cutter. Filing to the line might be almost as effective.

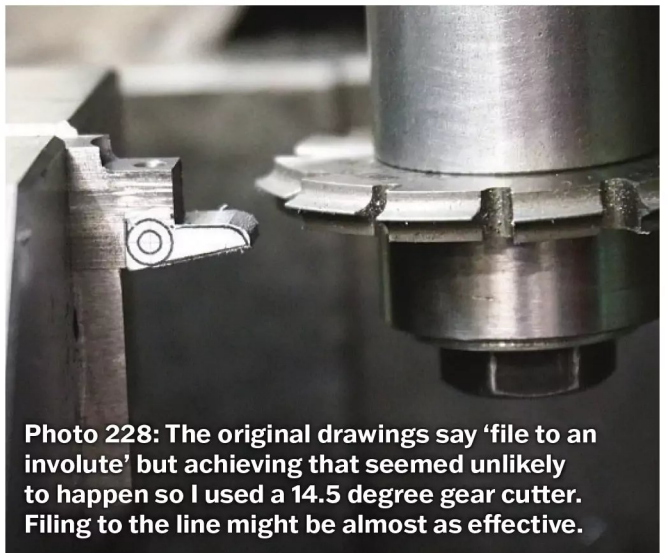


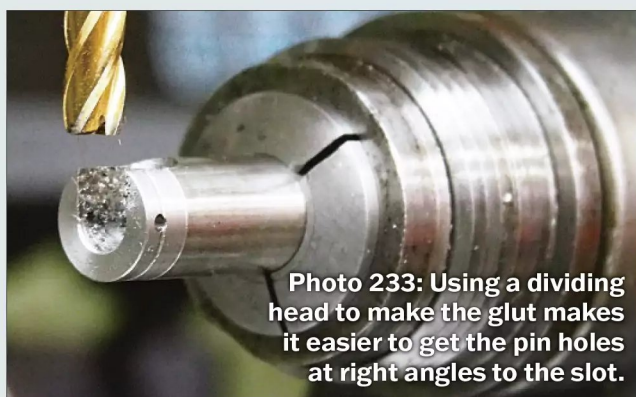
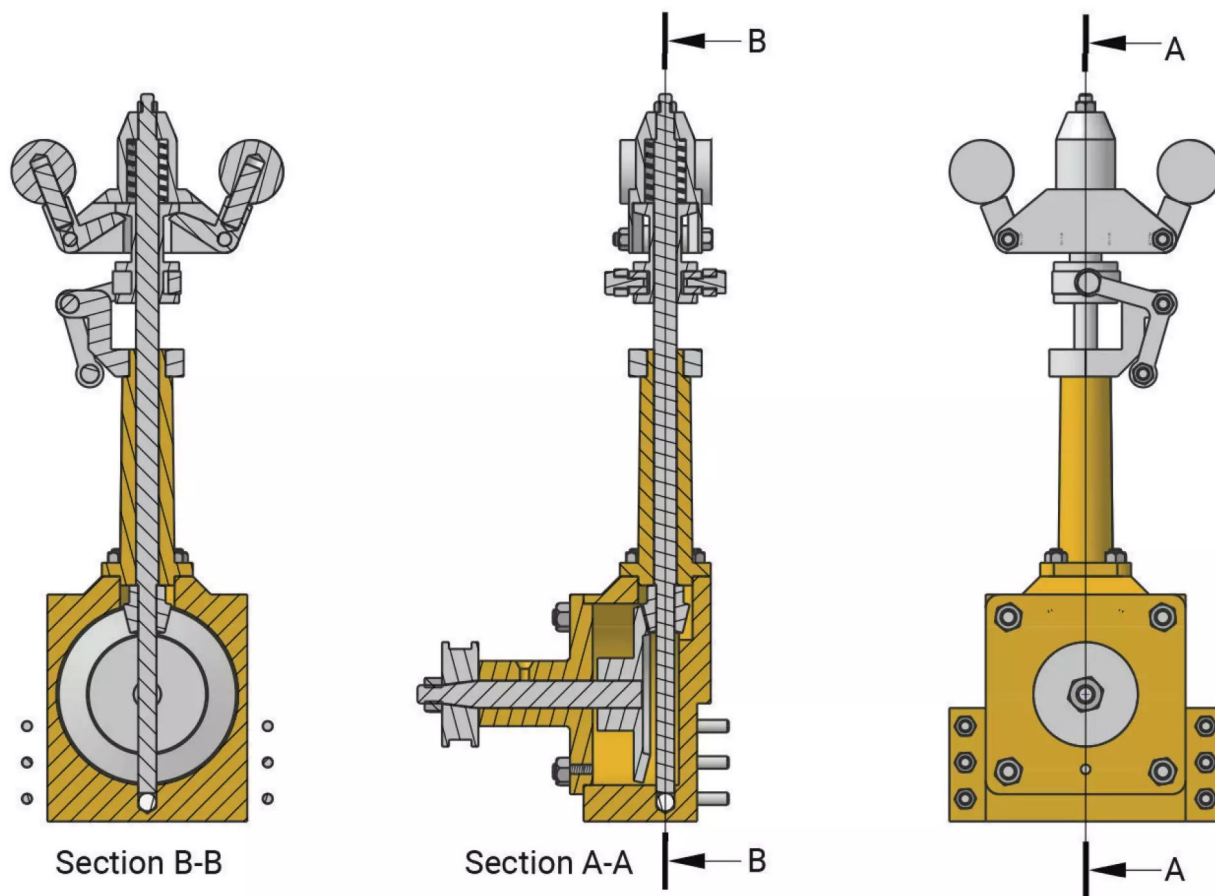
Photo 229: Reaming for a fulcrum pin.



Photo 230: Cleaning up the end of a weight lever after sawing from the stock.



Fig 37: Governor assembly and sections.



a family group with the weights pinned and glued (JB Weld) in place.

The easy way to get the glut pin holes square to the sides of the slot is to mount the stock in a dividing head and then a 90 degree rotation makes sure of it. In **photo 233** the stock has been turned to the OD and a hole drilled to start the slot which is now being formed with an end mill. The central hole was later filed eccentric to provide the necessary lateral clearance for the glut to be able to move freely to the limits of its travel.

The bracket that supports all the other bits is carved on the end of a piece of bar like lots of other bits, **photos 234** and **235**, then cut off and finished by filing to buttons, **photo 236**.

The stock for the levers (scrap in this case) was screwed to a piece of chipboard and the internal radii created by drilling to coordinates, **photo 237**.

The straight sides were machined in with a small slot drill, **photo 238** and the parts hacksawed out. Once again filing buttons were used to round over the ends and, with some careful lining up, the two levers were filed as a pair. For tasks like this one where the filing buttons need accurate alignment, the buttons need to be a good fit on the pin and the pin in turn a good fit in the hole in the part.

For the glut pins a short length of round bar was milled to hexagonal in the dividing head then the thread and pin formed on the end with the piece of hex held in a Griptru chuck, **photo 239**. In the absence of an accurate three jaw, an alternative would be to machine only a short length to hexagon and hold the remaining round bar in a collet.

The halves of the link that connect the governor to the Corliss valve gear were turned from free-cutting stainless and the narrow tool with the divided end came in useful again for reducing the inner portions, **photo 240**. **Photograph 241** is a family group of the bracket, spindle and levers and **photo 242** shows the completed governor prior to painting. I'm going to leave that until I've done as much as I can to get the governor functional.



Photo 241: The assembly of the spindle, glut and levers; a very satisfying little collection of bits to make.

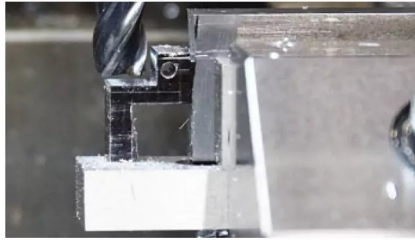


Photo 235: More work on the embryo bracket.

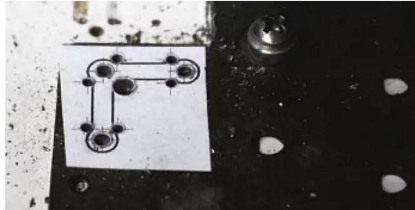


Photo 237: Stock for the levers was screwed to a piece of chipboard. The internal radii were formed by drilling...



Photo 239: Short lengths of round bar were milled to hexagonal in the dividing head then the glut pins formed on the ends in a 3-jaw Griptru chuck.



Photo 236: The completed bracket with the filing buttons used to round over the ends.

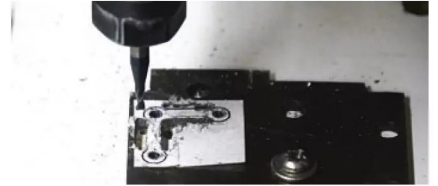


Photo 238: ...then the straight sides formed with a small end mill, the parts hacksawed out and finished by filing. Once again, filing buttons came in handy.

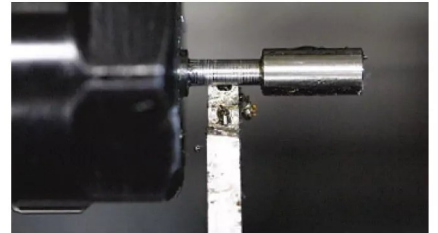


Photo 240: The 'parting tool' with a divided end came in useful again for shaping the links.

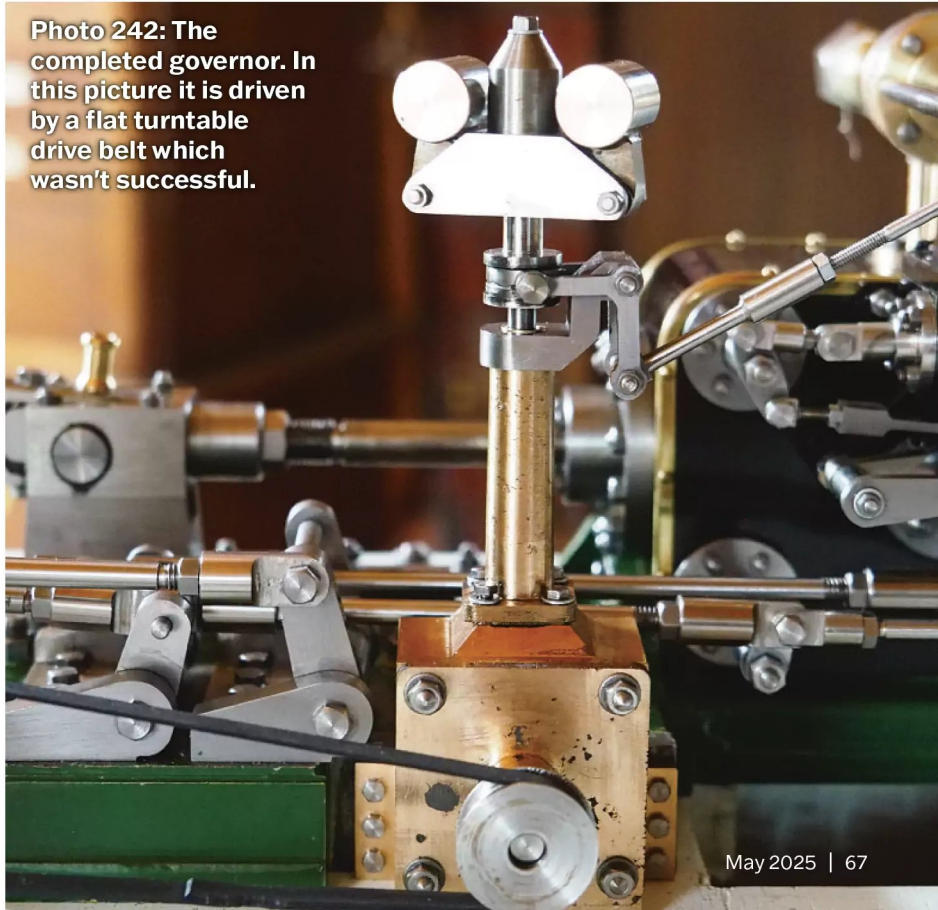


Photo 242: The completed governor. In this picture it is driven by a flat turntable drive belt which wasn't successful.

The BR Standard 2-6-0 Class 4 Tender Engine

PART 15

Doug Hewson takes a break from the valve gear and continues by looking at boiler construction for this standardised version of the LMS Ivatt-designed Class 4 in 5" gauge. 155 of these locomotives, known as Moguls, were built for British Railways.

Photo 115: Joe Gibbons starts a winning run.

THE BOILER

I know that this is jumping the queue a little, but I thought that I would get on with the boiler at this stage as I was hoping that people might be interested in ordering one from one of our advertisers in Model Engineer & Workshop. With my own, I stuck to the design with two rows of superheater tubes as I had done with my 4MT. It has proved to be a very efficient engine and, in fact, Joe Gibbons came first with 80080 in the Stephenson Memorial Locomotive Trials, **photo 115**. A great achievement! The photo shows Joe speaking to someone at the beginning of his run. I am a big believer in maximising superheat in our 5" gauge locomotives, especially effective when the superheaters get hot

- and the double row of elements mean that they get super-hot! In any event, it would be a good idea to fit the second row of tubes as - you never know, you may be overcome by a senses of guilt later on in life when you realise what a mistake you made in not fitting them.

The flanging plates for the boiler are identical to the ones used on my 4MT, not that this will help you a lot but I just thought you would like to know. It has the usual tapered section and then a parallel section where it meets the smokebox. I made formers for the inner and outer wrappers for my boiler, but I am awfully sorry that I have mis-laid my photos of them. I began my own boiler by flanging

Photo 116:
Firebox
tubeplate.

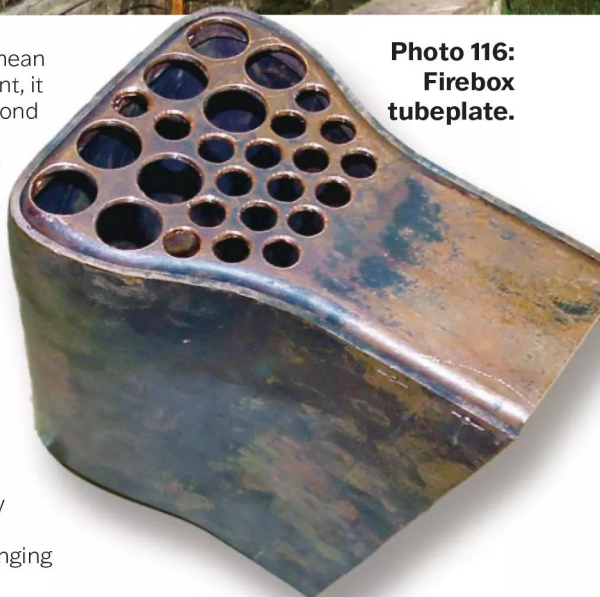




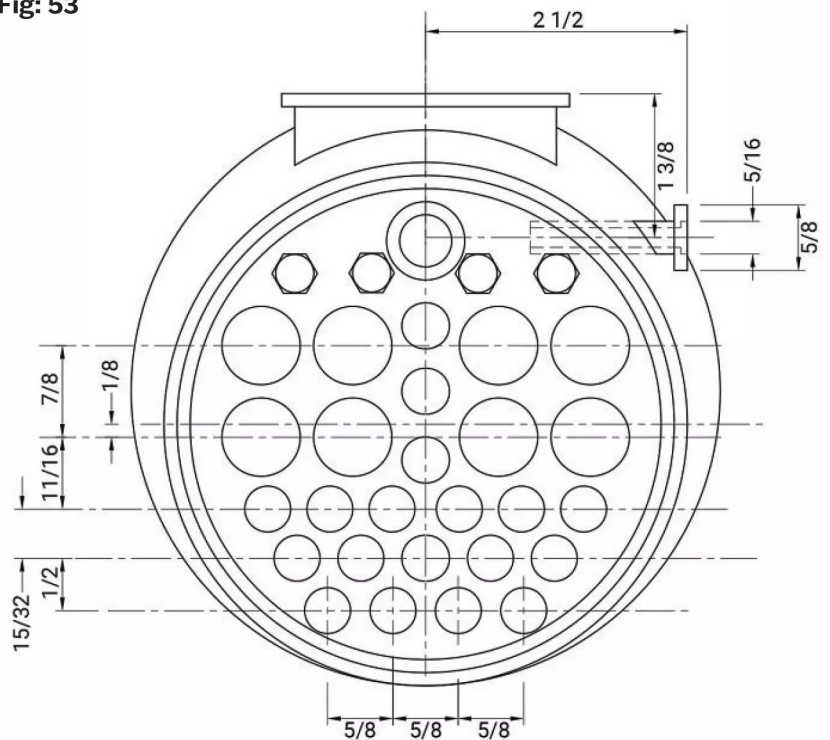
Photo 117: Boiler backhead awaiting soldering.

all of the plates and then fitted the wrapper plates around them. **Photograph 116** shows the firebox tubeplate with the tube holes all drilled and **photo 117** shows the boiler back plate ready for silver soldering in position.

Now, the next photo, **photo 118**, illustrates the time when I realised that there was more to this boiler making than I first thought! Even though I had built several boilers before, I had always blindly followed other people's drawings without giving a lot of thought to the job in hand. This new boiler was mine and after looking at the tubeplate in the photo I thought 'why don't I use at least two rows of superheater flues in my own boiler?' But I then thought that I might be going a bit too far! Had I realised at the time, I could actually have used three rows and then it would be just like the full size locomotive. The photo shows the discarded tubeplate from 80072 when it was being re-built from ex-Barry condition.

What set me off on this little caper was the fact that I had bought fifty or so solenoids for my signals from the late lamented Whistons and with this bundle came a free gift. The gift was a pack of metre lengths of 5/32 stainless

Fig: 53



View On Front Tube Plate

Fig: 54

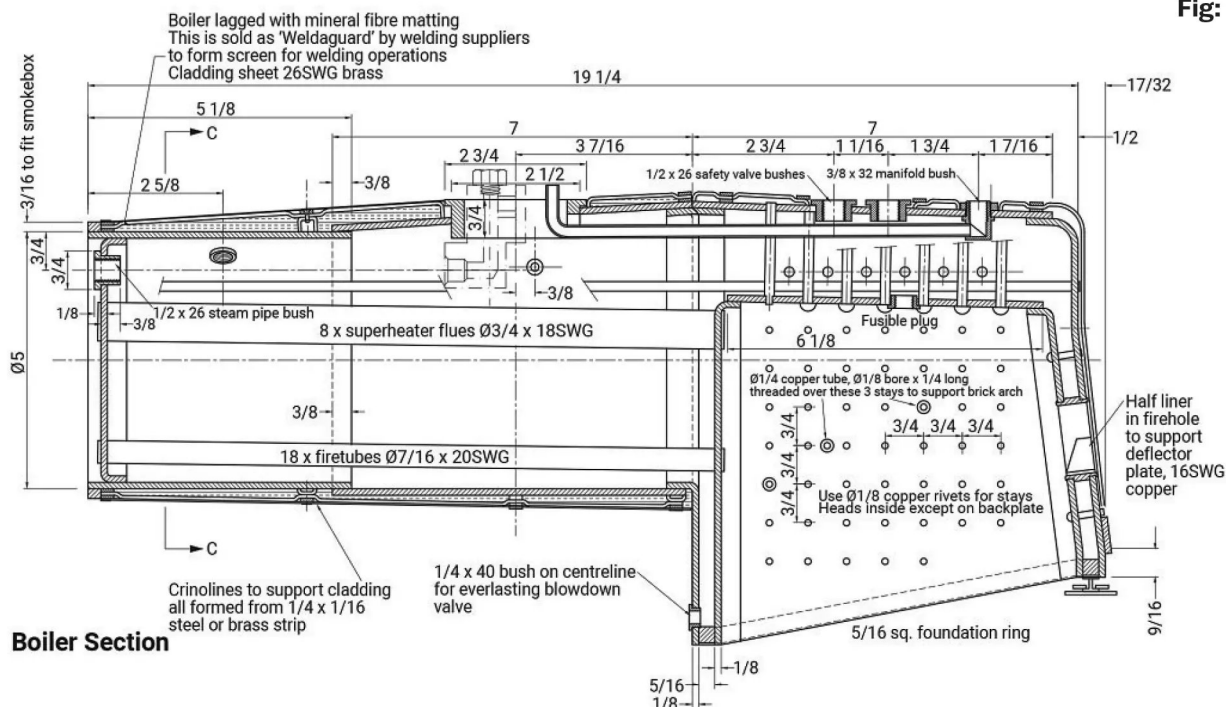


Fig: 55

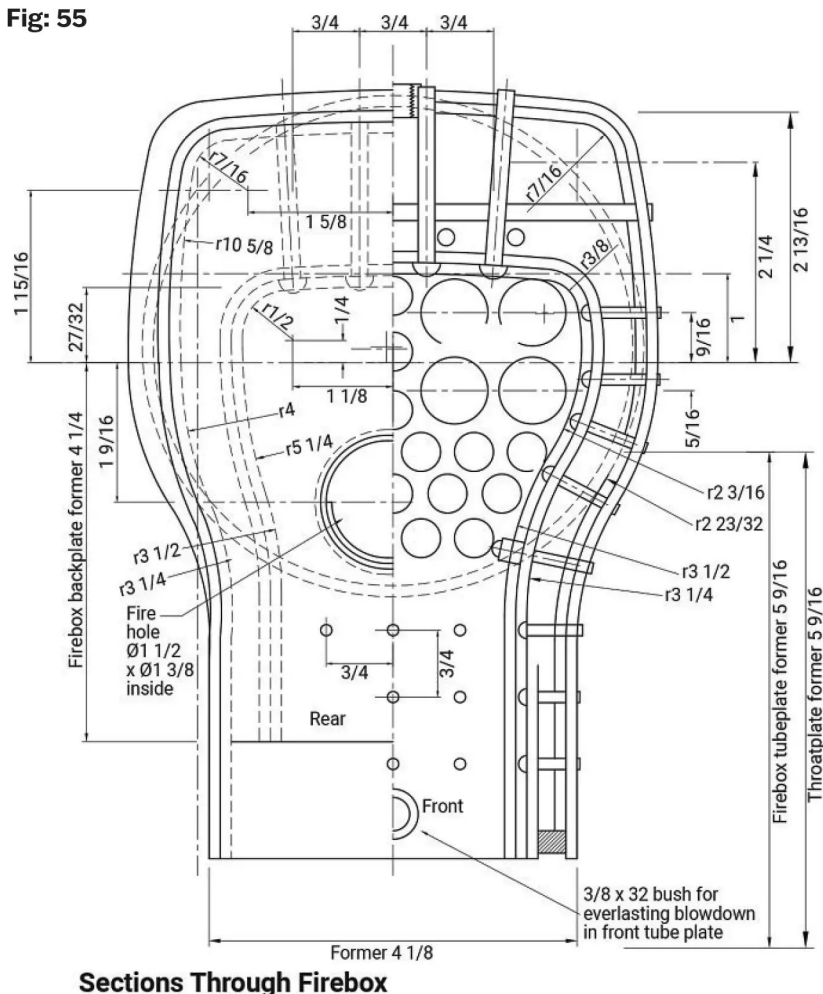


Photo 118: The tubeplate of one of the class, No. 80072.



steel tube and I was told that it could be bent double without it kinking! My Y4 needed some new superheaters so I thought, right, I will give it a try. This was good news because with the old elements I always got a soaking when I opened the regulator. I fitted the new ones and couldn't believe what I was witnessing. I kept trying to shovel coal into the firebox, but it was already full! We then fitted our other members' Y4s with similar superheaters and they just loved them. Ballan Baker fitted a set in his K1 and won IMLEC with it - and that was with only three elements in his engine. I am used to shunting flat out at Gilling and I used to visit the water column every 25 minutes or so but this time the Y4 would last about 40 minutes. I only carry the water that's in the Y4 tanks (I think carrying spare water around with me is cheating)



and apart from anything else, people just love to see an engine taking water at the column. Playing to the public - I know! **Photograph 119** shows the boiler of 76077 standing outside at Toddington. This photo is courtesy of Toddington Standard Locomotive Ltd.

Photograph 120 shows my firebox with the old fashioned crown stays in there, but note the three stays at either side to support the brick arch, which never got fitted! You can, however, see that the silver solder has penetrated nicely and the eight (though you can only see six from here) superheater flues. Apart from the main drawing, I have drawn a couple of little gadgets for swaging the tubes locally a little, and for any beginners it is well worth making the two of these, one for the superheater flues and one for the normal smoke tubes. It just saves a bit of frustration as it will prevent the tubes from slipping down into the firebox.

Photo 121 shows a tube in the lathe undergoing a little expanding. **Photographs 122 and 123** show the partly completed job with a little bit more work to do on the flange and the tubes to silver solder in. The pickle tank, **photo 124**, was bought from a local Plumber's Merchants and at last the firebox was in the pickle. **Photograph 125** shows the tubeplate of 76077 being removed by Leaky Finders in their own workshops and, funnily enough, it seems to have a lot more superheater flues than my 4MT. Very strange!

Now, we have a reader who sent me some lovely photos of the 2-6-0s in action so someone must read my articles! In **photo 126** (courtesy of John Billard) we see one of these Moguls at Feltham in 1967. This is 76011 on shed and just look at that lovely little steam crane along side it. Where I used to work we had lots of those working in our timber yard but I never took any photos of them as I thought they would be there forever.

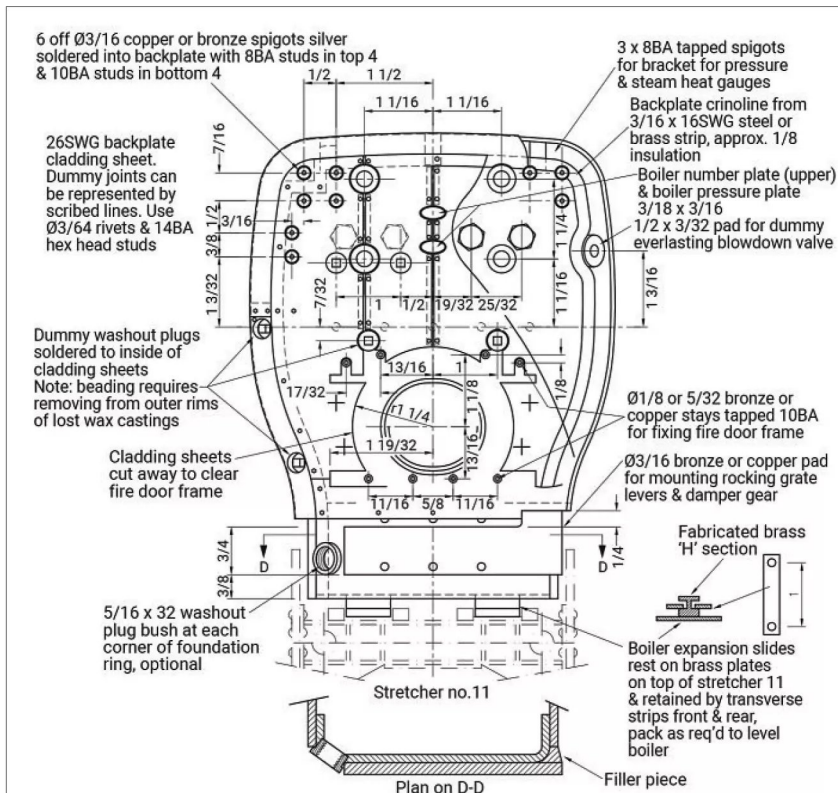


Fig: 56

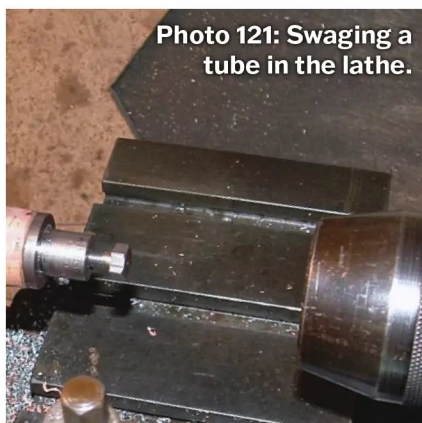


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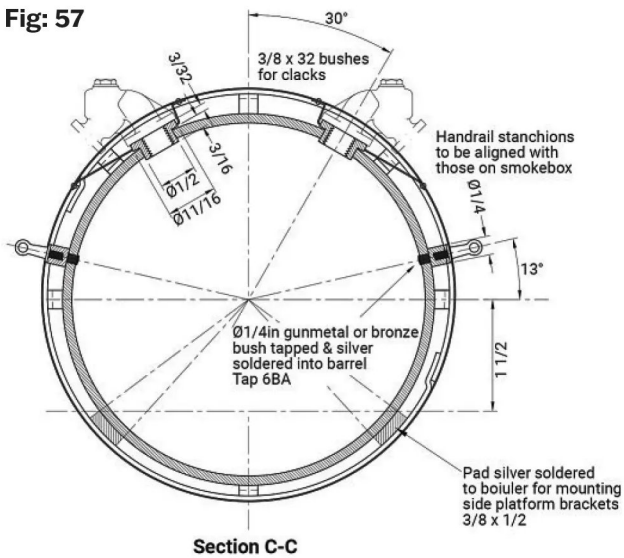


Photo 123: Another view of the tube nest soldered into position.

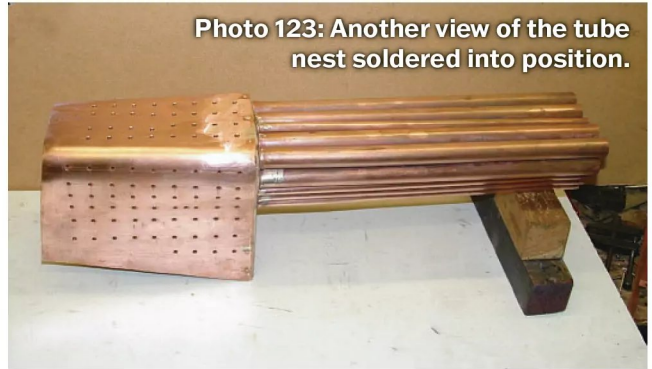


Photo 124: Pickling bath.



Photo 125: Removing the tubeplate of a full size Mogul, 76077.

Photo 126: A nice, contemporary photo sent to me by John Billard.



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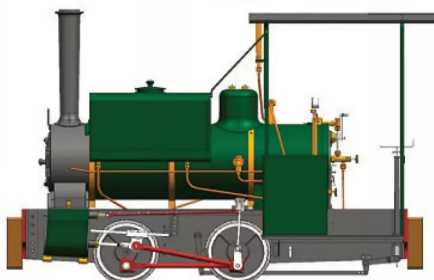


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3D PRINTED METAL PARTS

Having a benchtop 3D printer that will produce metal parts is still in the future for hobbyists, but as **Neil Wyatt** finds, we can now access this industrial technology to produce parts to our own designs.



Photo 1: Lost-PLA brass castings and a 3D printed pattern.

The 3D printing of metal parts is a mature technology – it's used to produce parts for aircraft and rocket engines as well as Formula 1 cars, so strength and reliability issues should not be a worry. In fact, a reader who has had parts made told me those he had made were stronger than equivalent castings.

These days, availability of foundry services is poor – particularly those willing to cast the smaller items we often need – and turnaround times are often long. Now we have the alternative of designing our parts in a 3D CAD program and receiving the finished items in two or three weeks.

PCBway, a China-based company that many readers will be familiar with for producing electronic circuit boards, recently started advertising such a metal 3D printing service to readers. I contacted them to find out more, and they offered to produce a small part for me to demonstrate the process.

The part I used as a sample is the

crosshead for a 1:12 scale model of an early 19th century house-built steam engine. **Figure 1** is part of a contemporary engraving of the engine. The crosshead is guided by two cylindrical bars and, subject to a little licence on the engraver's part, we see rollers at each end of the crosshead and a socket for the piston rod. A cross section at 90 degrees confirms a short shaft runs through the crosshead and the connecting rod is forked with two cotter and strap bearings.

I fabricated larger parts such as the cylinder and A-frame of the engine, but for some small, complex parts such as the upper guide bar supports and the governor frame, I 3D printed patterns and used them to make 'lost PLA' castings in brass, **photo 1**. It appeared the crosshead would be more challenging. Even a casting would need a fair bit of machining, tricky stuff as the part is only about 32mm across.

I had already made a 3D model of the crosshead in Alibre Atom 3D, **fig.**

2. I updated my model a bit as I had incorporated extra material to facilitate casting. I 'proved' the model by making a 3D resin print, **photo 2**.

Ordering the part from PCBWay is done online; the initial stage only takes a few minutes; you upload an STL and choose things like material and surface finish. The choices were aluminium, mild, alloy, tool or spring steel, stainless steel, brass, copper or titanium. Imagine the benefits of being able to order a complex form tool that only needs finish sharpening, or working scale

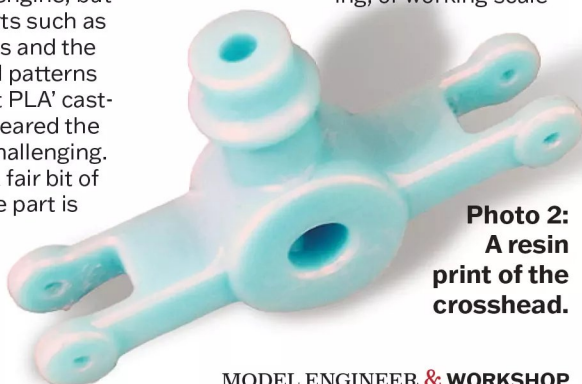


Photo 2: A resin print of the crosshead.

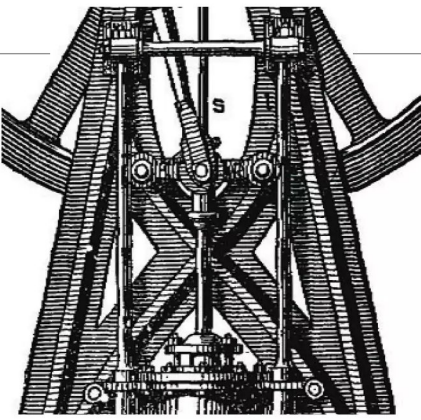


Fig 1: 19th Century engraving showing the crosshead and guide bar arrangement.

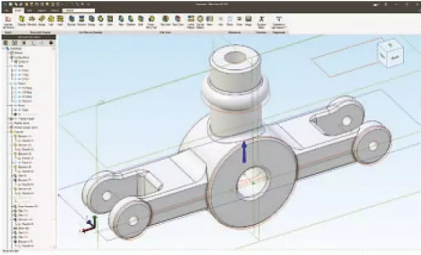


Fig 2: The crosshead modelled in Alibre Atom 3D.

springs! They also offer a wide range of 3D printed plastics as well, by the way. While I had planned to cast the part in brass, I decided aluminium would be equally appropriate, as the part will be painted and there would be less risk of me damaging it when drilling (as brass can 'grab' drills).

Usually you will get an instant quote, if you accept standard warnings about things such as small sections and threads, but if you want, their engineers can check your part before you get sent a quotation. Prices are material dependent, and there is a minimum cost.

The part took less than two weeks to be produced and shipped from China. It arrived with some promotional stickers protected in a bag and foam sheet within a branded cardboard box. The



Photo 3: The 3D printed aluminium crosshead, supported for drilling.

aluminium part was more accurate than the resin part, which had some slightly distorted edges, however the resin part had higher resolution, so the edges were crisper. Nevertheless, the surface finish and detail were exceptionally good, **photo 3** et seq., much better than my lost wax castings.

I chose to use small pilot holes but I now realise the accuracy means holes that just need finishing by reaming or drilling would be best. Because of the small section of the part I used a scrap of hard copper sheet to support the arms for drilling, **photo 3**. This is a number 55 drill (1.32mm) for 12BA clearance and the process was uneventful, as was drilling and reaming a larger 0.125" hole for the short shaft through the body. The hole for the end of the piston rod was simply drilled, **photo 4**. It was possible to grip the print in a vice without distorting it, and I found no tendency for the tooling to grab. There were no voids in the material which appeared completely solid. I had assumed the sintered material would be porous, but this was not the case. Although classed as 'aluminium' it is clearly an alloy of some sort as indicated by its strength and machineability.

To allow the little 'rollers' I made for the crosshead to fit, I had to file the inside of the 'arms' a little – the alternative was making the rollers narrower

than I wanted. **Photograph 5** shows a temporary assembly of the crosshead resting between the guide bars and on the cylinder top cover. Incidentally, the A-frame behind was made by silver-soldering six different laser cut parts together, a replacement for a slightly undersize version I hand-cut from steel sheet(!), I hope to complete the model in the summer.

THE COSTS

PCBWay arranged for this sample to be produced for me, the part was costed in dollars but would have been about £22 plus VAT. Fast shipping is costly, but you can choose Global Economy shipping which is cheap and takes 8-10 days. That means about £25 for a single part, which is comparable with the cost of a bespoke casting from your own pattern. Bear in mind that this is a small part. I put some other parts into the configurator and I was surprised how large a print could be before the cost increased even a little. The costs also come down for multiple orders.

In conclusion, I am impressed by the result and I will certainly consider metal 3D printing for complex parts of my future models. 🌟



Photo 4: The crosshead with all holes drilled.



Photo 5: The crosshead with rollers fitted, offered up to the model.

These articles by Geometer (Ian Bradley) were written about half a century ago. While they contain much good advice, they also contain references to things that may be out of date or describe practices or materials that we would not use today either because much better ways are available or for safety reasons. These articles are offered for their historic interest and because they may inspire more modern approaches as well as reminding us how our hobby was practised in the past.

Further DRILLING METHODS

TO ENSURE horizontal accuracy in hand drilling, some types of hand and breast drills are provided with small built-in spirit levels. Thus, using such a machine horizontally, keeping the bubble central will maintain the line of the hole horizontal, and looking at the drill from above, it is easy to see if reasonable squareness obtains in the other direction.

For verifying the accuracy of the built-in level (and it is always advisable to test one's tools), another small level is required. The accuracy of this is first tested by placing it on a surface to bring the bubble central, then turning it through a half circle and observing that the bubble is again central. After which, the level can be laid on a stiff true drill or piece of rod held in the machine chuck, when the bubbles of both levels should lie centrally.

If required, a machine without a built-in level can be aligned in this manner, placing the level on the drill before commencing, then re-checking when the hole has progressed a little way but not so far as to prevent correction if necessary. Yet another method is to hold a small square to the work and align the drill to the blade.

On occasion it is necessary or desirable for one hole or series of holes to be vertically below another as may happen in hanging doors or gates in existing surrounds. Then a plumb line dropped from the upper hole(s) will provide the line on which to position the lower.

For the occasional angle drilling job occurring in circumstances when it is not convenient to employ gauges described in the previous issue, adjustable types are useful equipment. From any type of protractor, they can be set on a nearby flat or straight surface, then applied to the work.

For round or flat stock

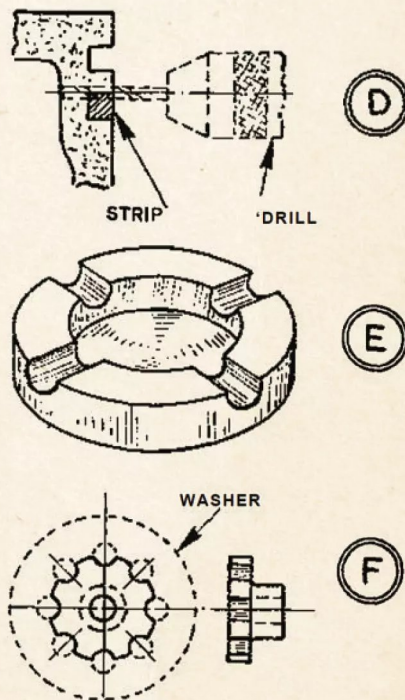
The gauge at *A* can be made from angle iron 1 in. on the flat, 2 1/2 in. long for the base, with a blade about 3/32 in. thick, 3/4 in. wide, 2 1/2 in. long. The pivot should be a screw with a wing nut for holding the blade when set.

An alternative type, *B*, for use on either flat or round stock, may have the same general dimensions; but the angle iron should be slotted at the corner to accept the blade centrally, a small lug then being attached each side to take the pivot screw and wing nut. This gauge may be set with a protractor on either round stock or a flat surface, then employed as *C*.

If rivets are used for fixing the lugs, the holes should be countersunk in the underside of the angle iron; and to hold the gauge on round stock, there can be situated in the base back from the blade an upstanding screw on which to hook the ends of a stout rubber band (from an old motor tube) passed round the round stock.

Half-round holes produced by drilling may on occasion be necessary as a feature of components, though at times the principle can be employed as a convenience or an alternative to other methods.

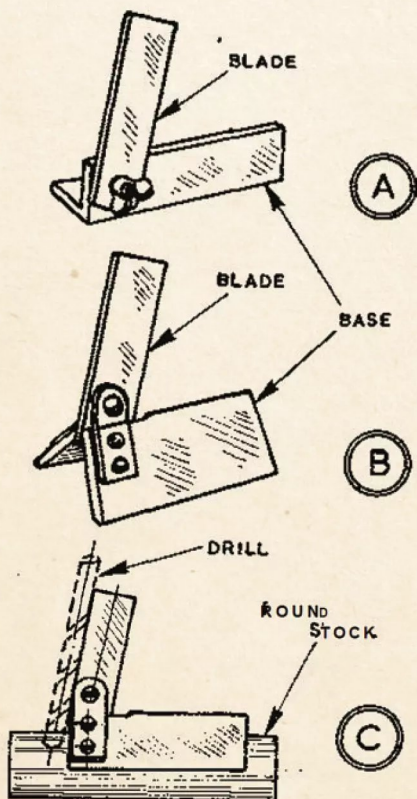
An example of the necessity for half-



round holes is the provision of locating pegs for piston rings of small two-stroke engines. On large pistons using wide rings, locating pegs can be in the grooves; but on small pistons such pegs would take up too much space. Consequently, a fitting half in the grooves, half in the lands is desirable. Drilling can be performed as *D*, with a strip wedged in the groove. The hole may then be tapped not quite through, the strip removed, and a peg (of brass) screwed tightly in, snipped off and filed flush.

Another example of such drilling can be seen in ash trays made from flat discs of brass or aluminium. If they are made in pairs, each with the centre turned out, they can be clamped face to face for the drilling, which should be followed by reaming if possible. When opened, a neat effect is revealed? *E*.

The principle is applicable to small handwheels or knobs for models, when a close-fitting washer is placed over for the drilling, *F*. Given reasonable care, the result again can be very neat.





Club News

Geoff Theasby reports on the latest news from the clubs.

When I was in York for Railfest 2004 I spotted a windmill in the distance, out to the West. What with one thing and another (idleness, asthenia) I didn't visit until mid-February 2025. Perched as it is on a slight eminence, fully two metres above the surrounding land, Holgate mill is a preserved, working mill, grinding and selling wholemeal flour. It is still driven by the wind, although it has an electric backup for when demand exceeds supply. In 1770, when built, did the local residents complain about the 'visual intrusion' as their modern counterparts do? If they did, they were rightly ignored. We need to eat before we consider the beauty of our surroundings. If you, dear Reader, are blessed with the sort of outlook that regards pylons and wind turbines as marvels of modern industry and design... see <https://www.holgatewindmill.org.uk>. I did not find out until afterwards, but York Cold War bunker is also to the West of the city centre, kept as it was when the doors were closed in 1991. A tour of the bunker, which must be pre-booked, takes about two hours. <https://www.english-heritage.org.uk> In this issue: a charger, a long title, the Last Word, give me a sign... a dedicated editor, a PhD, a bike, valves and audiophiles, a pun, a flatpack, a Wheelhorse,

garden railways and servos. At lunch in the Station Hotel, I wanted to plug in my electric scooter to recharge the battery, whereupon the socket decided to take up the practice of entropy and the electricians joined in so we had to push it back to Sheffield (with some assistance of Cross Country trains). The train was crowded, overflowing into the lobbies, but at least I had my own seat. The following day I attended to the errant recharging connector only to find that I couldn't reach it. I had to indulge in major dismantling to access the underside; it took a day and a half to rectify the problem, although it took less than a minute to fall apart. Ho Hum. These things are sent to try us, as was said about Judge Jeffries. On the Monday, Debs and I attended a Newcomen Society talk on Trinity House. This is the organisation founded by Henry VIII in 1514 (or nearly a quarter past three) and still retains its full, original name; *The Master Wardens and Assistants of the Guild Fraternity or Brotherhood of the Most Glorious and Undivided Trinity and of Saint Clement in the Parish of Deptford Strond in the County of Kent*. So there! Pity the poor minion who had to address envelopes. Lest anyone should erroneously surmise that my interest in windmills, radio towers, pylons and lighthouses as

an aberration, I can only say that it's a fallacy.

In Leeds Lines, from **Leeds SMEE**, Jack Salter notes the passing of Arthur Bellamy, a mainstay of the Society for many years. He drove through the transfer of the Society's move from Temple Newsham to Eggborough. He was professionally involved in the commissioning of the then new power station in the 1960s. Arthur wrote to the Cabinet Office to recommend Cherry Hill for an award. Shortly afterwards Cherry was featured in BBC Radio Four's *Last Word*. This was possibly the only time a model engineer had been so honoured. Jack Salter, who knew of Arthur long before they met, was described as the one in the striped blazer and straw hat, officiating at IMLEC. W./ www.leedsmodelengineers.co.uk

The Monthly Bulletin from **Bradford MES** reports that the first event of the season was Graham Astbury's talk on combustion. A visit is planned to Byworth Boilers in Keighley (so named after the town motto, *By Worth*, a pun on the river Worth flowing through the town and its industrial past). A visit to Keighley MES is proposed as 2025 will be Keighley Society's 75th year. Road Vehicle News spotted a 'Duchess of Hamilton' scooter painted in LMS red complete with yellow 'whiskers', **photo 1**. Jim Jennings showed his miner's lamp fitted with blue glass instead of the usual clear glass. These date from WW2 and the blackout so aircraft overhead could not see them, **photo 2**. W.www.bradfordmes.uk

An unusual sign was spotted near Knaresborough by Nigel, who was walking an old railway line but could not trace its purpose despite his best efforts. The answer was provided by John Charlesworth who recommended <https://www.railsigns.uk/sect25page1.html> It appears that it was part of a cut-price signalling system unique to the LNER Knaresborough-Boroughbridge-Pilmoor line. The things you learn!

Graeme Quayle sends the **MEEA** newsletter, apologising for any inconsistencies as M***Soft are leaning on him to get 365. He therefore compiled the missive in Open Office, with which he is not familiar. Then his computer gave up the struggle so he had to use



Photo 1: Scooter in LMS colour scheme. (Picture courtesy of Ian Jackson.)



Photo 2: Blackout miner's lamp.
(Picture courtesy of Jim Jennings.)

his wife's machine. All in all, four and a half days sitting at a computer is TOO MUCH! Murray Lane is unwell and spent a few days in hospital recently. He is developing his painting abilities although, being colour blind, he has to take advice on the colours. John Burnett visited a coffin factory.

He thought it was quite weird being surrounded by coffins of all sizes. Brian Baker made four knives from old saw blades. He then mentioned a new recycled plastic from Critical Design which uses old fishing nets and reconstituted milk bottles as raw materials. It is made into 1200 x 2400mm sheets for table tops, wall panels and the like. It is not called Carnation, but perhaps it should be. (Made from from condensed milk bottles.... Geoff.) Mike Jack has been ringing the changes with J. B. Weld. Is there anything this wonder material can not do? Graeme Quayle has been doing strenuous things with the Foden steam wagon, assisted by the odd recycled expletive. Chairman, David Court brings us up to date on **P2 Cock o' the North**, with their newsletter, The Streamliner. Dr. Adrian Wilby has completed his PhD on Materials Science at Sheffield University. Congratulations to him! Turnout for the AGM was rather low but the Trust is in a good financial state. There is a collection of videos on YouTube: search for 'Doncaster P2'. Our attention is drawn to the nine month celebration, S&DR200 to celebrate 200 years since the Stockton and Darlington Railway was opened. W. www.cockothenorth.co.uk

York City and District SME Newsletter, March, begins with Brian Smyth writing on the rebuilding of *Vulcan*, the 5" gauge Class 08 shunter. The original is still running at the Worth Valley Railway. Cliff Hudson writes on a 6 million dollar parking ticket. Tony Simons updates us on the Drewry shunter, WD37 at the Derwent Valley Light Railway. W. www.yorkmodelengineers.co.uk
PEENS February, from **Pickering Experimental Engineering and Model Society** features President,

Jonathan writing, tongue in cheek, to say that there are two whole articles to read in this issue. Let joy be unfined! Anyone thinking of contributing should not stay their hand. (Imagine Lord Kitchener pointing out of the picture, 'Your Railway needs YOU!') Rob Davey discusses a main bearing, crankshaft and big end overhaul on the Velocette motorbike. It is quite comprehensive (eight pages). The main customer was the police, from which the term 'Noddy Bike' arose. The bikes had an enthusiastic following and when the company closed, the owners' club, after negotiating for 22 years, bought the entire stock and set up in business for the manufacture and sale of spare parts. This is followed by 'Can Hi-Fi ruin your life?' Colin Bainbridge explains, with the emphasis on valves. Starting again with the safety notice - High Voltages/ Currents Can Kill! (Valves, High vacuum, High voltage, NPN transistors perhaps ...?) This subject is also covered quite comprehensively (seven pages). There will be more. To answer Rob's question, yes it can. Don't listen to the purists who seem to prefer second harmonic crossover distortion to third harmonic crossover distortion or the difference betwixt valve and transistor amplifiers. The ultimate test, I suppose, would be to compare a piece of music played through otherwise identical systems, using a typical transistor amp, a comparable valve amp and a 'class A' amplifier. The only change would be in the operation of each amplifier. I have never seen this done yet. In a nutshell: second harmonic distortion, third harmonic distortion and no harmonic distortion. As for audiophiles, the less said the better, but if you insist ... Peter Belt is a good place to start.

UK Mens Sheds report the restoration of an observatory by Seiriol Mens Shed, Beaumaris.

Raising Steam, the newsletter of the **Steam Apprentices Club**, part of The National Traction Engine Trust, arrives. A bumper edition of 64 pages. Victoria's Torton Tales denotes the travels of the Club's mascot, *Lady Sylvia*, around the UK in seven pages. John Rex Model Engineers has donated a water cart to the SAC. It was received as a flat pack and it is hoped it will be up and running by mid-Summer. Joshua Williams writes on his activities in the T/E field. In November the Steam Plough Club was visited, to find that their museum does not just contain traction engines! 'Steam it Sunday' contains a good view forward from the footplate of an unidentified showman's engine.

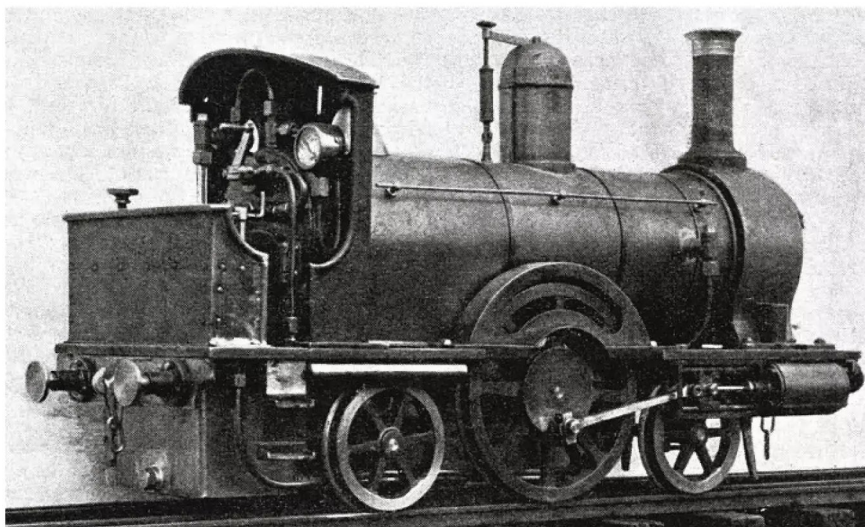


Photo 3: Curly's Ancient Lights. (Picture courtesy of C. J. Grose.)



Photo 4: The Flying Hamburger. (Picture courtesy of Michael Füg.)

Elijah Bell writes 'from the archive'. This concerned a Garrett six-wheel undertype wagon. They were successful but outclassed by the Sentinel DG6. There's an unflattering view of a Garrett that had crashed through a bridge parapet and landed inverted, not showing its best side. This was followed by pictures of some heavy loads, one on a low loader possibly built for the job. W. www.ntet.co.uk In 1944, 'LBSC' was sent the remains of an old locomotive, a 2-2-2 rescued from some children pulling it around on a string. Curly reckoned it to have originated in the 1860s. He eventually rebuilt it as 3½" gauge, Ancient Lights, **photo 3**.

Kingpin, Spring, from **Nottingham Society of Model and Experimental Engineers**, has a picture on the front showing the new bridge over the A60 being crossed for the first time by a DMU. The Midlands MEX is being run this year by Jayne and Nigel Ball, whilst Sophie Harris built a loader and backhoe attachments for a 'Wheelhorse' tractor. Being given the small tractor by her father, Sophie, in the knowledge that the proper Wheelhorse attachments were no longer available, designed and built the devices using the correct mounting points, using an hydraulic pump to power the fittings. The machine has been successfully used to prepare the earthworks at Ruddington. 12 December saw the visitors' and members' Open Day, reviewed by

Nigel Mundy. This event attracted a comprehensive collection of locomotives. Later, Tom Ingall brings the latest news from the Great Central renewal project.

W. www.nsmee.org.uk

Here's a picture of the Flying Hamburger (far side) with a Henschel 61002 and Rudolf Caracciola's Mercedes-Benz, W154 racing car *Silver Arrow*, **photo 4**.

The **Frimley Flyer from Frimley and Ascot Locomotive Club** opens with an instant cure for a broken lavatory flush handle; a ring spanner! Simple! Paul Naylor writes on *Old Rube* which is a US Baldwin Class 70 built by Graham's father in 7¼" gauge. The controls are 'agricultural' and it weighs about 350kg. He also decided that as he grows older, having a means of moving items around on wheels as opposed to lifting them, will be beneficial to well-being. Fortunately, the locomotive came with a lifting crane. W. www.flmr.org G1MRA Newsletter and Journal does not disappoint, despite the Editor mixing up two photos, incorrectly labelling an Australian 2-6-2 as a 2-8-4 Mikado (easy done! Dep. Ed). Jim Smith moved house and built a garden railway, telling how he did it. Alan Beasley continues his build of a Bulleid Leader. Peter Jackman describes 3-D printing of closed nose points and crossings. John Boyson refurbished a West Highland Class 27 and prints a Mk1 Carriage and its

detailing. Chris Ludlow comments on Gauge 1 and his paintings, whereas Tony Armstrong asks, is it costly? And the answer appears to be, of aluminium rails on plywood or decking, about £12 per metre. Norman Millier writes on 3-D prints in metal, **photo 5**. The next item is Living with a Garden Railway by Dick Moger. John Perkin makes a Southern Region brake van (Queen Mary) and Henk Wierebga made another garden railway whilst Ralph Bagnall-Wild modified a servo tester to do useful work. The Letters Page discusses at length some serious thoughts to which members' responses are invited and will appear in the next issue. Abbreviated versions and responses from the committee are printed here.

W. www.g1mra.com

And finally, the inventor of Velcro has died. RIP ☹



Photo 5: 3-D printing in metal, a Class 01 shunter. (Picture courtesy of Norman Millier.)



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All laser cut parts for Gerald Martyn's "1366" design as featured in this magazine.

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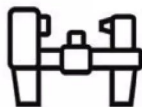
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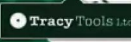


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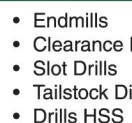
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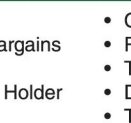
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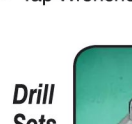
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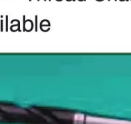
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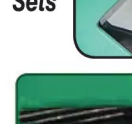
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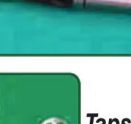
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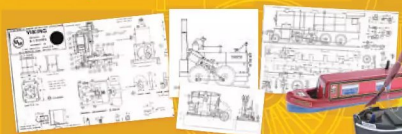
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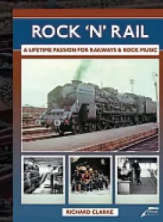
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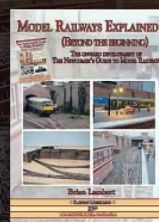
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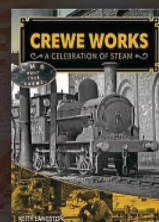
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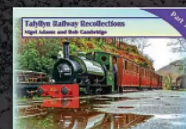
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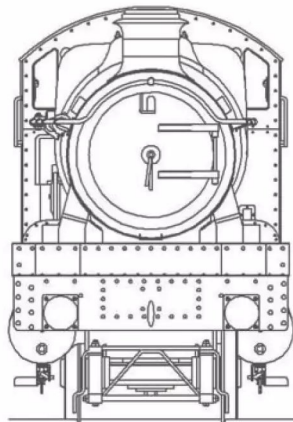


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