

MAKE A HOLDER FOR LARGE TAPS

MODEL ENGINEER & WORKSHOP

EST. 1898

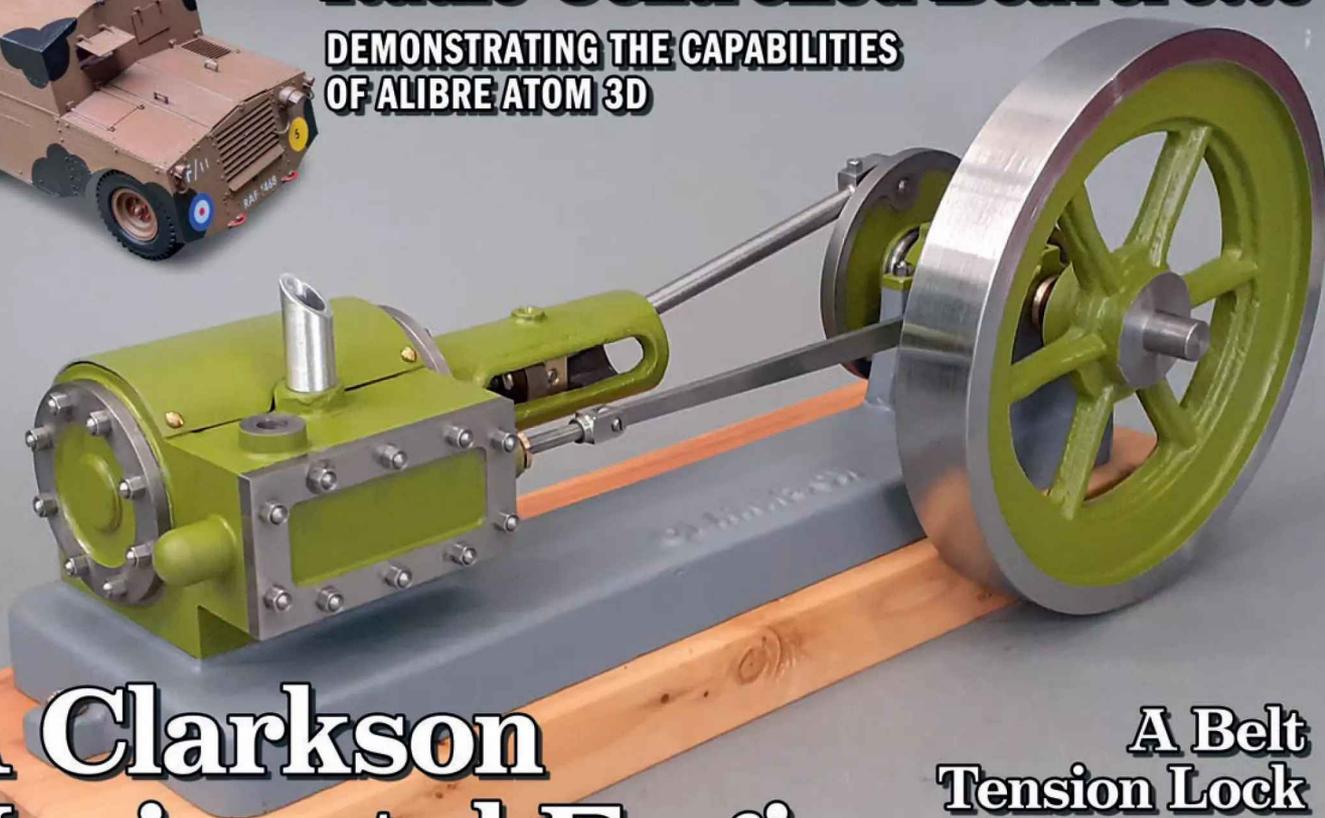
THE LEADING MAGAZINE FOR HOBBY ENGINEERS AND MODEL MAKERS

www.model-engineer.co.uk

Volume: 235, Issue: 4774, March 2026



Radio Controlled Beaverette DEMONSTRATING THE CAPABILITIES OF ALIBRE/ATOM 3D



A Clarkson Horizontal Engine

A Belt Tension Lock A DESIGN FOR PROXXON 230 MILLS.

JASON BALLAMY WITH A FULLY METRIC DESIGN
FOR BEGINNERS, BASED ON PROVEN CASTINGS.

INSIDE this packed issue:

- COMPLETING THE PANNIER TANK ENGINE
- UNDERSTANDING VIBRATION
- SURFACE PLATE STORAGE AND HANDLING
- VISITING BENTLEY MINIATURE RAILWAY
- QUARTERING LOCOMOTIVE WHEELS
- LB&SCR TERRIER
- COMPLETION OF THE SOLAR TRAM
- A VACUUM EJECTOR IN 5-INCH GAUGE
- PLUS ALL YOUR REGULAR FAVOURITES!



GET MORE OUT OF YOUR WORKSHOP WITH **ME&W**



MARCH 2026

£6.10



FROM PROTOTYPE TO PRODUCTION



No Compromise
on Cost or Quality

From Prototyping to **Mass Production** — **High Quality, Fast Turnaround, and** **Cost-Effective** Manufacturing



PCBWay is a global manufacturing service provider trusted by engineers worldwide. We offer a wide range of services such as CNC machining, 3D printing, injection molding, and other manufacturing solutions — all delivered with high quality and speedy turnaround times.

Instant Online Quotation //

Upload your 3D data files (STL, STEP, IGES, etc.) and receive an immediate price estimate — no need to wait for manual quotes, so you can quickly move forward.

Orders from Just One Piece //

Perfect for prototyping, testing, or personal projects. No minimum quantity restrictions, so you can try us out with ease.

High Quality at Competitive Prices //

We deliver excellent cost performance without compromising on quality, outperforming many domestic options.

24/7 Customer Support //

Our dedicated customer support team is available around the clock to assist you with any technical inquiries or order updates — ensuring peace of mind whenever you need it.

CNC Machining “From \$24.89”

Supporting a wide range of precision cutting techniques including 3- to 5-axis milling and turning for complex shapes.

Sheet Metal “From \$24.89”

Laser cutting, bending, and welding services capable of handling intricate metalwork.

3D Printing “From \$4.98”

Offering SLA, SLS, FDM and other technologies ideal for producing high-precision prototypes.

Injection Molding / Vacuum Casting

Flexible solutions from simple molds to mass production tooling, including multi-cavity and insert molding.

PCBWay

www.pcbway.com · service@pcbway.com

EDITORIAL

Editor: Neil Wyatt
Designer: Druck Media
Illustrator: Grahame Chambers
Publisher: Tim Hartley

By post: Model Engineer & Workshop,
 Kelsey Media Ltd, Media Centre,
 Morton Way, Horncastle, Lincs LN9 6JR.
Telephone: 01507 529589
Email: neil.wyatt@kelsey.com
 ©2026 Kelsey Media Ltd.
ISSN: 0033-8923

CUSTOMER SERVICES

General Queries & Back Issues
Email: cs@kelsey.co.uk
Telephone: 01507 529529
 Mon-Fri: 8.30am-5.00pm

ADVERTISING

Group Advertising Manager
Sue Keily
Email: sue.keily@kelsey.co.uk
Telephone: 01507 529361

Advertising Sales

Fiona Leak
Email: fiona.leak@kelsey.co.uk
Telephone: 01507 529573

PUBLISHING

Sales & Distribution Manager: Carl Smith
Publishing Director: Dan Savage
Published by: Kelsey Media Ltd, Media Centre,
 Morton Way, Horncastle, Lincs LN9 6JR

SUBSCRIPTIONS

Full subscription rates (see inside for offers):
 12 months, 12 issues, inc. post & packing - UK
 £71.40. Export rates are also available, see
 www.classicmagazines.co.uk for more details.
 UK subscriptions are zero-rated for the purpose
 of Value Added Tax.

Enquiries: cs@kelsey.co.uk

PRINT AND DISTRIBUTION

Printed by: Acorn Web Offset Ltd,
 Normanton, West Yorkshire.
Distribution by: Frontline Distribution Solutions
 2 East Poultry Avenue, London, EC1A 9PT

EDITORIAL CONTRIBUTIONS

Accepted photographs and articles
 will be paid for upon publication. Items
 we cannot use will be returned if
 accompanied by a stamped addressed
 envelope, and recorded delivery must
 clearly state so and enclose sufficient
 postage.

In common with practice in other
 periodicals, all material is sent or
 returned at the contributor's own risk,
 and neither Model Engineer & Workshop
 Magazine, the editor, the staff, nor Kelsey
 Media Ltd can be held responsible for
 loss or damage, howsoever caused.

The opinions expressed in ME&W are not
 necessarily those of the editor or staff.
 This periodical must not, without the
 written consent of the publishers, be
 given, lent, resold, hired out, or otherwise
 disposed of in a mutilated condition
 or in any unauthorized cover, by way of
 trade, or annexed to or as part of any
 publication or advertising, literary or
 pictorial matter whatsoever.

This issue was published on
20 February 2026
 The next issue will be on sale
20 March 2026



SMOKE RINGS

WHAT TO BUILD?



The interests of ME&W readers cover a wide range of topics, what we all have in common is enjoying making things, especially things that 'work'. I've promised readers to try and increase our focus on projects that will get you into the workshop and making things.

In this issue as well as a number of useful workshop items, we start a new constructional series by Jason Ballamy, a relatively modest stationary engine. Jason has carefully amended the original design from **H. Clarkson & sons** to use all metric stock and fixings with castings from **Blackgates**. With full guidance for those embarking on a first steam engine, we expect

the series to have about five parts, so it's an ideal project for the Spring and Summer.

Of course, since the early days of *Model Engineer*, many readers have dreamed of building and driving their own steam locomotive. Unfortunately, while the skills can be acquired, not all of us have the time to build a working locomotive. Getting a model professionally built is one option, but another is to build from a kit. Such kits have improved greatly in recent years, with more use of CNC and other modern approaches to give greater consistency of fit and finish and hence more reliable results. In our next issue we will be starting another, relatively short series, following Mark Thatcher through the building of a 5" Gauge Live Steam **BR Class 1500** locomotive kit from **Silver Crest Models**.

As a final note, I hope to be able to meet many new faces among our ME&W readers later this year, as I follow in the footsteps of some earlier editors with a trip down under. Watch this space!



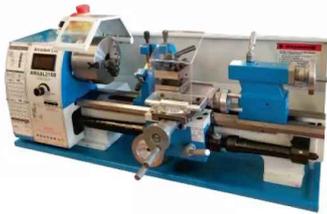
Neil Wyatt
 Editor



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

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

Price: £585



AMABL210D BRUSHLESS MOTOR 8x16- LARGE 38mm spindle bore

SPECIFICATION:
Distance between centers: 400mm
Taper of spindle bore: MT5
Spindle bore: 38mm
Number of spindle speeds: Variable
Range of spindle speeds: 50~2500rpm
Weight: 65Kg

Price: £1,185



AMABL250E-550 - VARIABLE SPEED LATHE - 38mm SPINDLE BORE & ELECTRONIC CHANGE GEAR SYSTEM (ELS)

SPECIFICATION:
Distance between centers: 550mm
Taper of spindle bore: MT5
Spindle bore: 38mm
Number of spindle speeds: Variable
Range of spindle speeds: 50~2500rpm
Weight: 140Kg

Price: £1,925



VM25H R8 with Belt Drive & Brushless Motor - HIGH SPEED - 100-4000 rpm

SPECIFICATION:
Model No: AMAVM25H (R8)
Max. face milling capacity: 63mm
Table size: 700x180mm
Range of spindle speeds 100-4000 rpm
T-slot size: 12mm
Weight: 120Kg

Price: £1,488

W DRO – Price: £1,921

W DRO + Z & X PF - Price: £2,382



XJ12-300 with BELT DRIVE and BRUSHLESS MOTOR

SPECIFICATION:
Gas Strut
Forward Reverse Function
750W BRUSHLESS Motor
Working table size: 460mm x 112mm
Gross Weight is 80Kg

Price: £725



VM18H High Speed - Milling Machine R8 with 3 Axis DRO

SPECIFICATION:
Model No: VM18 R8
Max. face milling capacity: 50mm
Range of spindle speeds 100-4000 rpm
Table size: 500x140mm
T-slot size: 10mm
Weight: 80Kg

W 3 AXIS DRO - Price: £1,692

For more detailed information about these machines, please visit our website. If you have any questions or need further assistance, feel free to contact us.



Prices inc VAT & Free Delivery to Most Mainland UK Postcodes

| Call: 0208 558 4615 | Email: info@amadeal.co.uk |



MPV290F-Movable Mill Head Lathe & Mill & Drill
Combination Machine with STAND

SPECIFICATION:

Distance between centers: 750mm
Taper of spindle bore: MT5
Taper of tailstock quill: MT3
Motor: 1.5kw
Weight: 280Kg

Price: £5,225



VM28H - High Speed - Ball Screw Type Milling Ma-
chines - R8

SPECIFICATION:

Model No: VM28H - R8
Max. face milling capacity: 63mm
Table size: 700x180mm
Range of spindle speeds 100-4000 rpm
T-slot size: 12mm
Weight: 120Kg

Price: £1,608

W DRO – Price: £2,142

W DRO + Z & X PF - Price: £2,734



**Clamping
Kits**



**Boring
Head
Sets**



**Parallel
Sets**



**Keyway
Broach
Sets**

Hi Spec Low Prices Why pay more?

We Accept



Regulars

3 Smoke Rings

The Editor shares his thoughts.

34 Readers' Tips

Our tips winner this month offers a 'helping hand'. Send us your tip, and you could win a prize.

40 Postbag

Our monthly selection of readers feedback and comment. Send the editor your letters at neil.wyatt@kelsey.co.uk.

56 On the Wire

News of engineering events to look forward to at home and abroad.

59 Club Diary

The essential guide to events at model engineering clubs around the UK.

77 Club News

Geoff Theasby's monthly report with news of engineering clubs across the country. Send him your news at geofftheasby@gmail.com.

80 Readers' Classifieds

Another great selection with plenty of machinery up for sale. If you have something to sell, email us the details or use the form in this issue, to neil.wyatt@kelsey.co.uk.

Visit our Website

www.model-engineer.co.uk

Why not follow us on Twitter? twitter.com/ModelEngineers hashtag #MEW

Extra Content!

There's lots of extra content to be found online to support past articles in Model Engineer & Workshop.

Visit the www.model-engineer.co.uk forum for extra content including:



See Jason Ballamy's Clarkson Horizontal engine in action.



Hot topics on the forum include:

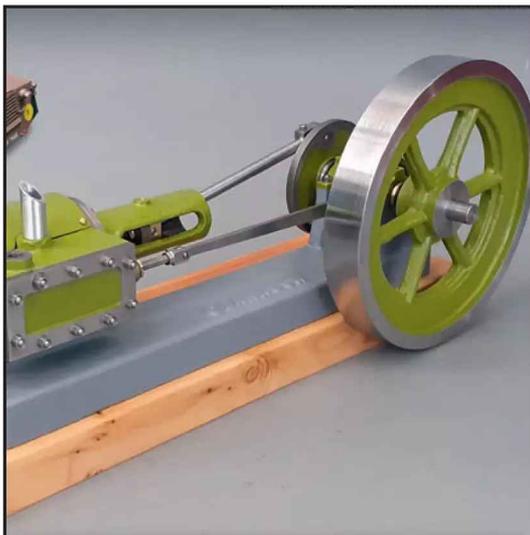
How do I learn machining ? started by paul1956.
A simple question with many answers, this thread is a useful read if you are just starting out in the hobby.

Removing Tarnish / Patina from Brass Components started by Graham Meek.
How best to remove tarnish and restore a polished surface.

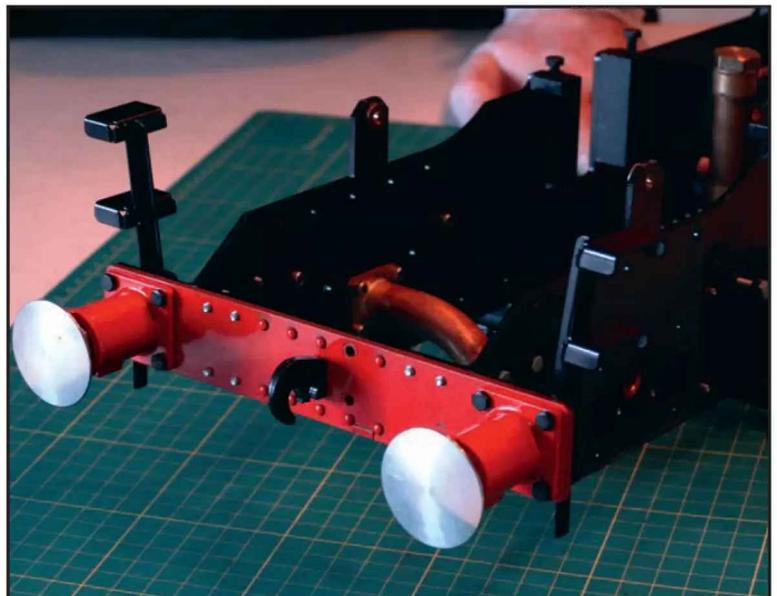
Change Wheel Holder started by John Purdy.
Some interesting workshop applications of 3D printing.

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 Next Issue

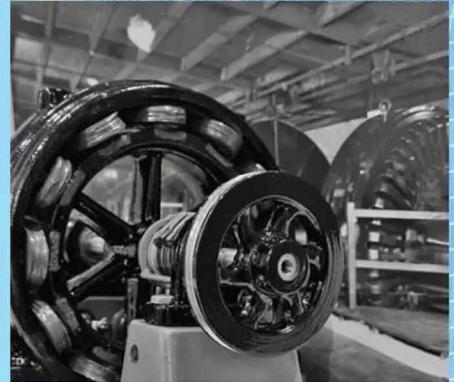
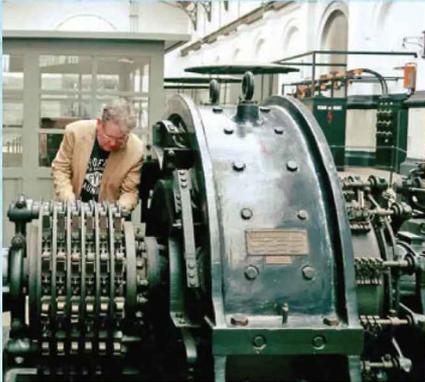


Our cover features Jason Ballamy's immaculate Clarkson stationary engine. Read more about the building of this ideal beginner's project from page 9 of this issue



In our next issue, Mark Thatcher embarks on building a 5" Gauge Live Steam BR Class 1500 loco kit, from Silver Crest Models.

Newton Tesla (Electric Drives) Ltd have been trading since 1987 supplying high power variable speed drives and electric motors to industry up to 500KW so you can be confident in buying from a well established and competent variable speed drive specialist.



New updated hardware for 2026

Managing director George Newton, originally from the British Steel industry where he worked with 20,000 HP rolling mill drives is also a skilled machinist and uses his own lathes to design and refine speed controllers especially for the Myford ML7 & Super 7

For the Myford ML7, George and his team produce the AV400, a complete 'Plug & go' solution including a new variable speed motor that meets the original Myford motor specification, has the correct 5/8ths shaft diameter and is a direct fit

The 'AV' range is extended with the AV550 & AV750 for the Super 7 lathe giving a choice of 3/4HP & 1HP motor power

Full Torque is available from motor speed 90 - 1,750 RPM

Advanced Vector control for maximum machining performance

Prewired and programmed ready to go

The AV400/550/750 speed controllers have an impressive 10 year warranty for the inverter and 3 years for the motor (Terms and conditions apply)

Over 5,000 units supplied to Myford owners

Speed control solutions also available for other lathes including Boxford, Southbend, Colchester, Raglan etc call or email for details

Technical support available by telephone and email 7 days a week



Newton Tesla (Electric Drives) Ltd.

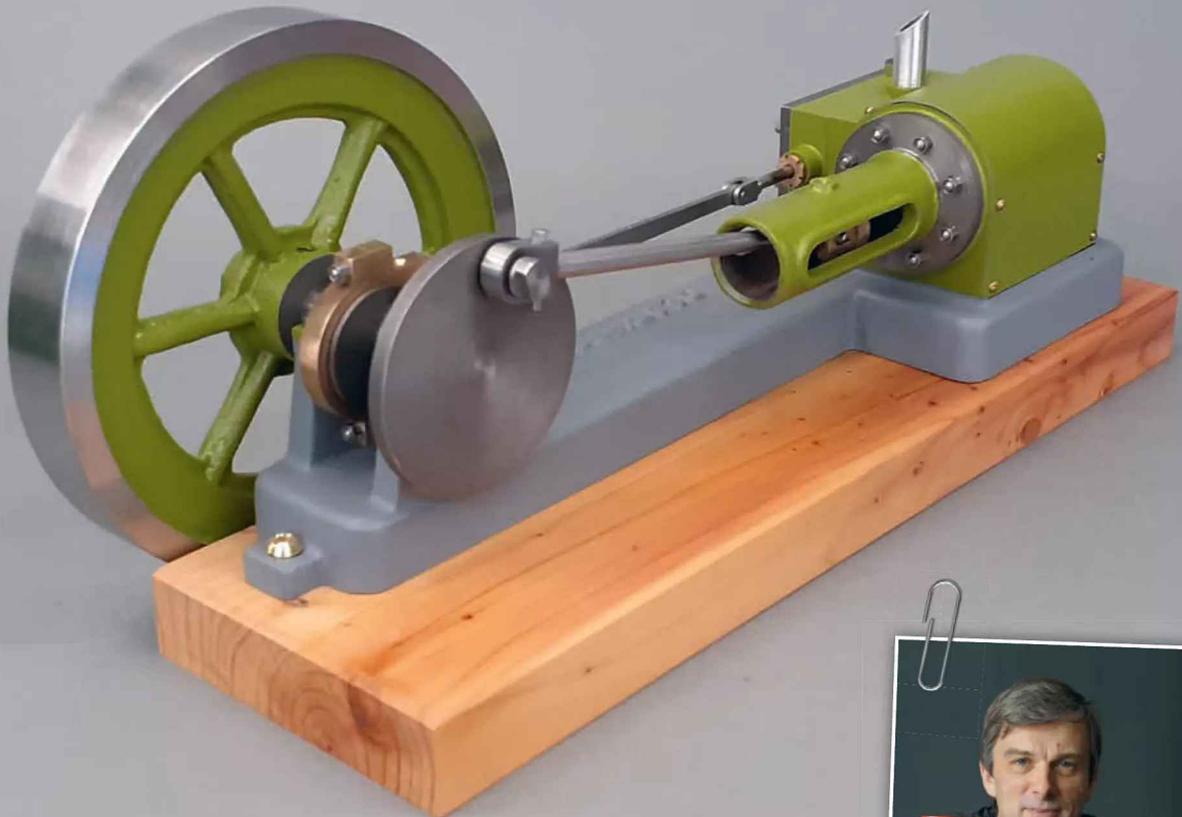
Warrington Business Park, Long Lane, Warrington
Cheshire WA2 8TX, Tel: 01925 444773

Email: info@newton-tesla.com

Visit <https://www.newton-tesla.com> for more information.

Follow us on Facebook: www.facebook.com/NewtonTeslaLtd





The Clarkson 24x38 Horizontal

PART 1

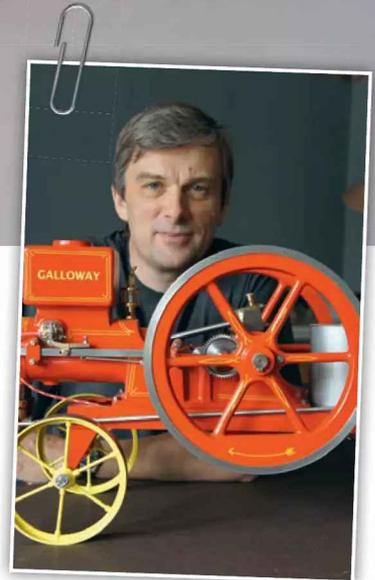
In a series aimed at beginners, **Jason Ballamy** details the making of a stationary steam engine.

For some time, I have felt that any newcomers to the hobby who want to try their hand at a casting kit have little option but to take the imperial/BA route as the usually suggested beginners engines come with imperial drawings, as well as bar stock and BA fixings. The latter two items being the main reason, as they feel the need to use what they have paid. Given that anyone entering the hobby now is likely to have been schooled in metric and may well already have some metric tooling, cutters, etc. it would seem logical to continue with what they know rather than stepping back to imperial.

However, there are alternative options that have not got as much of a following, so don't get suggested as much, which is possibly due to several

reasons such as not having been available for a period, drawings not being ideal for a beginner, etc. The advantage of this is that the kits consists of only castings so not only is the initial purchase price less, but the budding builder also has the option to buy what materials and fixings they need. The only real drawback is the drawings are still imperial.

Some of these alternatives are the old H. Clarkson & Son designs which have been reintroduced by Blackgates Engineering and the small 1" x 1.5" Horizontal and Vertical engines in particular. These are quite a simple design, so are ideal for a beginner to use as their first time casting set. With their separate trunk guides and disc type cranks they are also a less testing build than the usually suggested subjects.



THE MODEL

I recently picked up a partial set of castings for the Clarkson Twin/Compound with the intension of making quite heavy modifications to them, but for what I intended it would really have been better to start from scratch, so what to do with the castings?

There were almost enough castings to make a single, just the eccentric strap was missing but a new one was obtained from Blackgates, so work could start on designing a metric version of the single cylinder horizontal engine. I spent some time measuring up all the castings to ensure that what I drew could be cut from them. At the same time a few anomalies in the old drawings were sorted out as well as

Photo 1: The metric design in 3D CAD

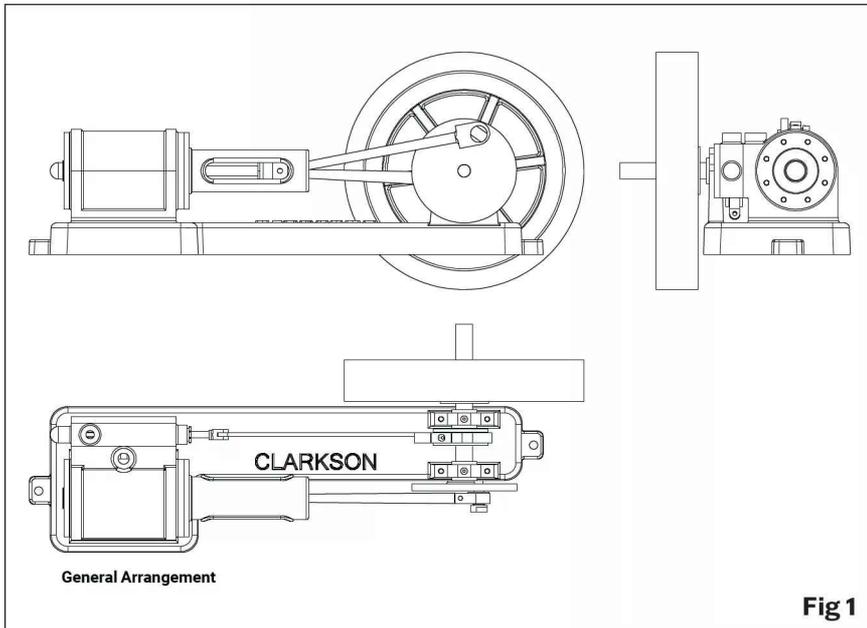
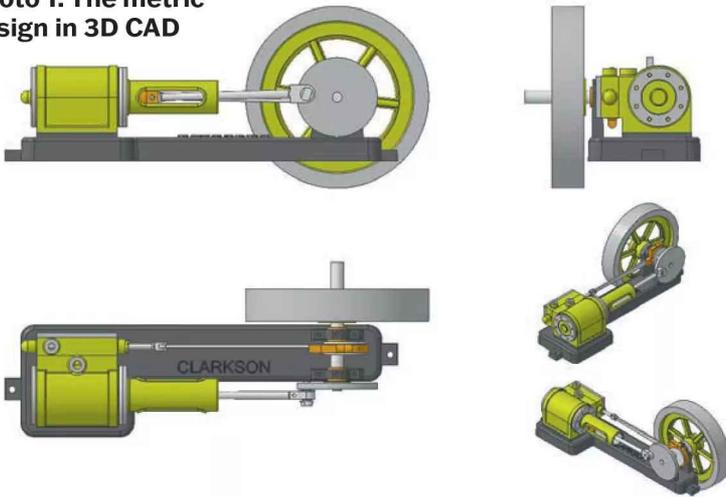


Fig 1

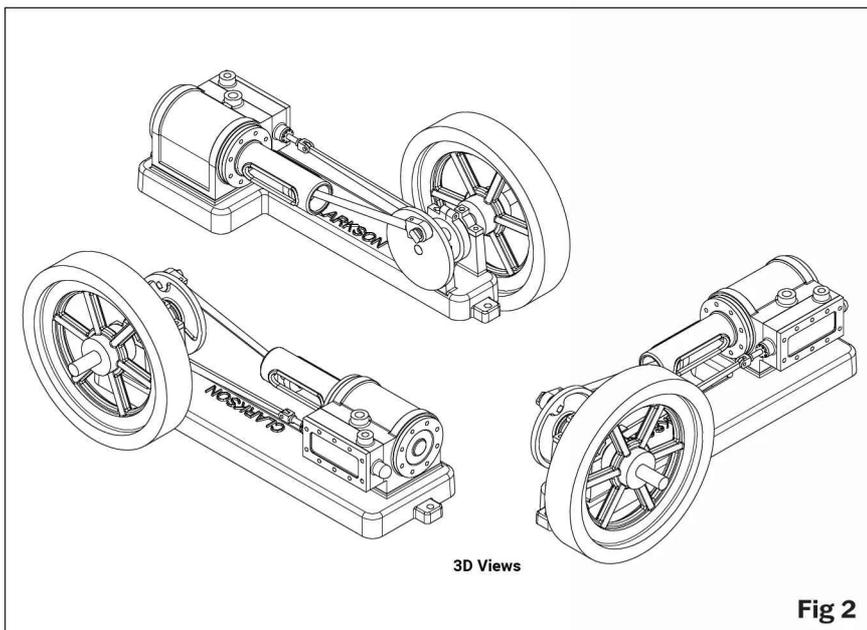


Fig 2

fully detailing some of the minor parts that lacked detail, which a beginner may not have been able to work out for themselves.

The render in **photo 1** shows some views of my metric version complete with a couple of extra features which will be covered at the end of this series of articles. It is not just a mathematical redesign where the imperial sizes are converted to whatever they are in metric but a complete redesign so mostly dimensions are to a whole mm not some odd three-decimal place conversion, materials are all stock metric sizes and threads and fixings are all metric too. See also **figs 1 and 2**.

I went with a 24mm bore, a size that I have used on quite a lot of other engines which is not as small and fiddly as, say a S50 or 10H, but not so large as to need large machines or cost a lot in materials. The stroke is almost the same at 38mm, as is the flywheel at 102mm diameter. Logic says a metric model would have a 100mm diameter flywheel but it is always better to keep model flywheels as big a possible as it helps to smooth out the action when running at slow speeds. Overall length is approximately 250mm.

CONSTRUCTION.

I made use of a bench top hobby mill on this engine, but it would be possible to do it with just a lathe that is equipped with a vertical slide. That would have been the way most of these engines were built when Clarkson's first produced them back in the '50s as most home workshops did not have the luxury of a milling machine.

I also have a lot of additional photos that would fill too many magazine pages, so as with my previous articles I will be running a accompanying thread on the Model Engineer Forum (www.model-engineer.co.uk) which will show these photos and also serve as a place for any potential builders to ask questions, etc. You can see the engine running in this video (or use the QR code): tinyurl.com/4sasdt9b





Photo 2: Set of raw castings



Photo 3: Underside of the bed casting after flattening

CASTINGS IN GENERAL

Photograph 2 shows the castings (less eccentric strap) laid out. Mine is the opposite hand to that supplied as the single but the drawings I have done are for the single so a few of my photos will be the opposite hand.

If this is to be a first casting kit engine, then a few words about castings. Firstly, spend some time examining them and the drawings so that you become familiar with them and how to hold them for the machining that follows. Check for any obvious external faults and that they are sized to allow the part to be machined from them.

Next, they can be given a clean up

with a wire brush to remove any sand that is still on the surfaces, as that is not a good idea to get onto machines and will also blunt tools. I also like to remove any 'flash' and lines left where the two halves of the sand mould met as well as surface blemishes before doing any machining. Old files, Dremel type tools with grinding points and good old elbow grease are all that is needed.

If, when filing, you run over an area that seems harder and resists being cut then there may be some chill in the casting which is more likely to be on a corner or thin narrow part of a casting. This chill can usually be removed by placing the casting in a fire so that it

is at red heat for an hour or two and then allow it to cool slowly in the ashes overnight. Carbide insert tooling can usually cope with these chilled areas but can become expensive if the part needs drilling or threading, where the cost of these carbide tools can soon add up.

BEDPLATE

The first thing to do is to smooth off the bottom surface so that the casting sits on a flat surface without any hint of rocking. This can be done initially with files and then fine tuned by rubbing the casting over a sheet of abrasive laid on a flat surface, photo 3 shows the

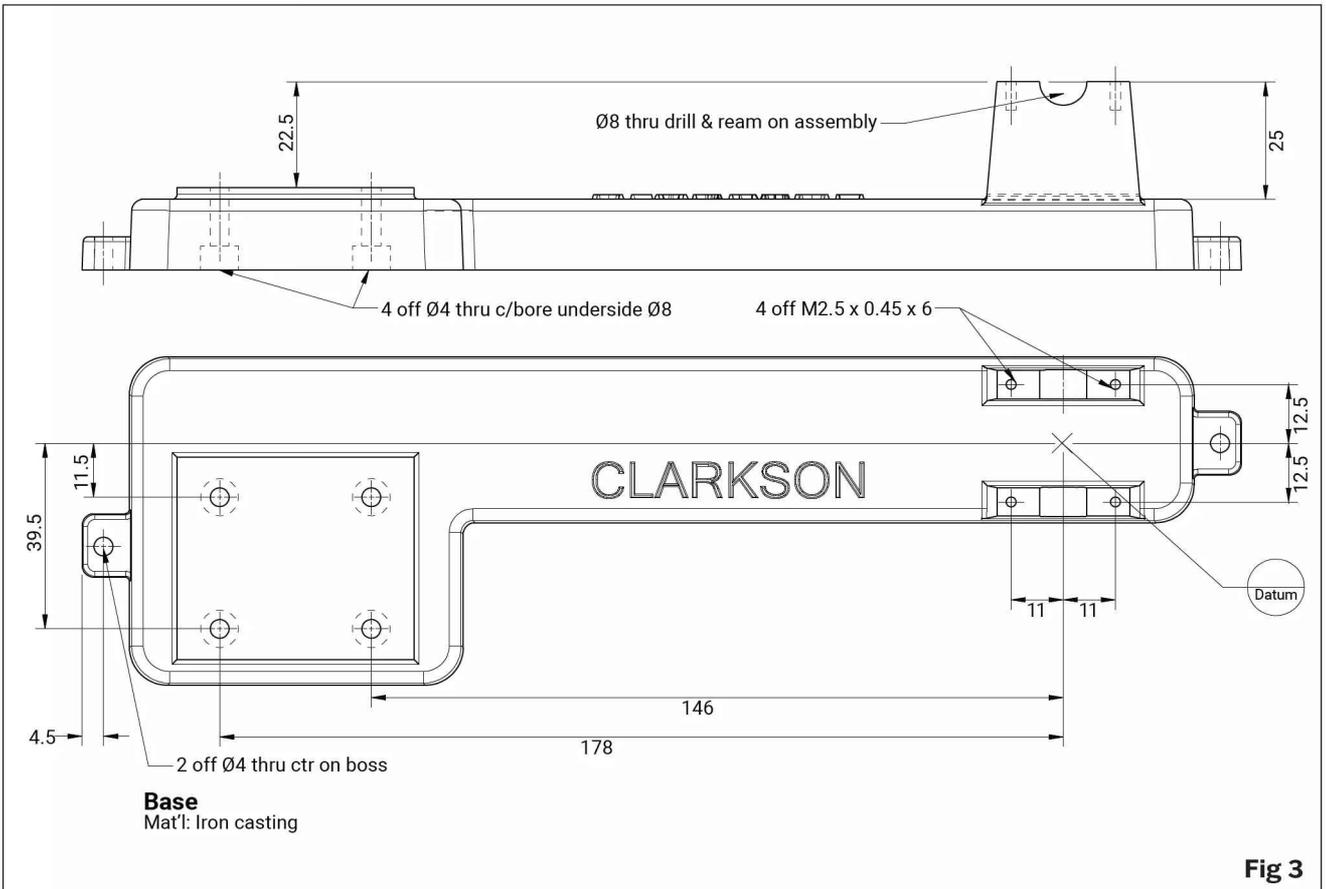


Fig 3



Photo 4: Machining pedestals and cylinder platform to height

results, the bright areas marked in red are where the casting makes contact with the abrasive, a little hollow in the other areas won't hurt but not the other way round, as a high point in the middle would allow it to rock.

Now that the bedplate can be clamped down without the risk of distortion it can be mounted on the mill, I used two buttons that fit the tee slots to set the side of the casting against so its parallel to the X-axis, mark where these Buttons touch for

future reference. A light cut or two can then be taken over the tops of the bearing pedestals to just clean up the surface. Zero the Z-axis dial and proceed to mill the cylinder mounting pad until it is the required height below the pedestal, **photo 4**.

Locate the datum point between the two pedestals with an edge finder or touching off and then do the same to set it in the other direction using the ends of the cylinder side pedestal, **photo 5** shows these points marked



Photo 5: Bed drilled and tapped

in red. From this datum point the various holes can then be, M2.5 for the bearing cap studs and 4.0mm diameter for the screws which retain the cylinder. Before disturbing this setup put something pointed into the drill chuck and use that to scribe a centre line across the tops of the pedestals. The underside of the 4mm holes can then be spot faced so the screws heads have a flat surface to sit against, a plunge cut with a milling cutter will do for this.

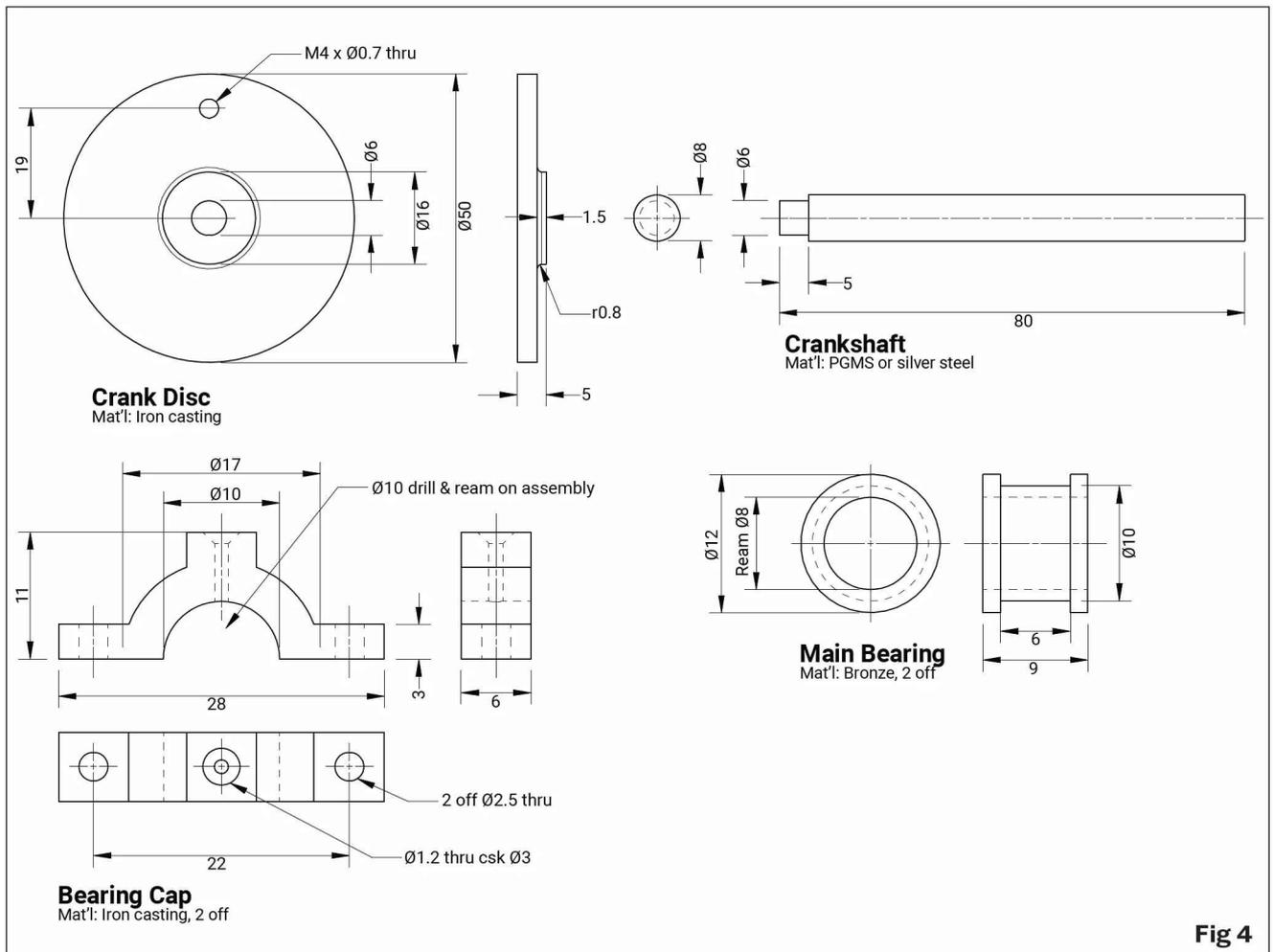


Fig 4



Photo 6: Initial machining of bearing cap sides



Photo 7: Milling bearing caps to thickness

BEARING CAPS

These are supplied cast as one, the first thing to do is machine some flat surfaces starting with the two ends. Run a file over the flatter face and then hold in the vice with that face against the fixed jaw and some aluminium packing against the other

face to give a better grip and take off just enough to clean up the face, **photo 6**. Flip the part over and with the newly machined face sitting on a parallel the opposite edge can then be machined.

These two faces can then be used to hold the casting and bring it down to the required 6mm thickness, taking

approximately equal amounts off each side, **photo 7**. Once that is done it can be held as before to bring down to the final length of 28mm. Blue one side with a sharpie or marking blue and scribe a line to guide you and then hacksaw into the two caps, then take a light cut to clean up these sawn surfaces.



Photo 8: Milling and drilling bearing caps



Photo 9: Blending bearing caps into pedestal

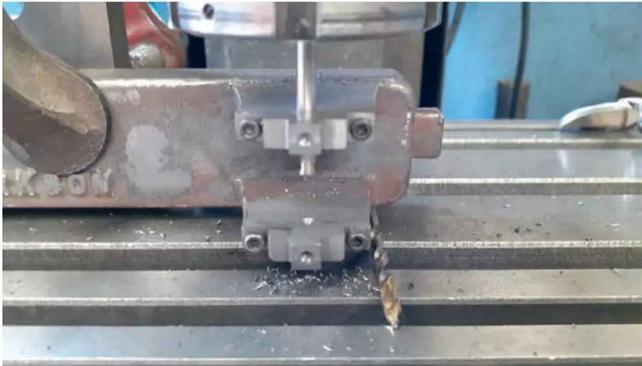


Photo 10: Spotting position of lower bearing hole



Photo 11: Reaming for bearings



Photo 12: Filing bearing caps to final profile

With a tall parallel in the vice to support the cap the remaining features can be machined. Firstly the width and thickness of the two ends followed by the height and width of the oil boss.

Then the hole positions can be spotted taking the spot drill quite deep to form the oil recess and then finally the

2.5mm and 1.2mm hole can be drilled, **photo 8**. You can see that I make regular use of a vice stop when doing multiple parts as you then only need to locate the position of the first one.

MAIN BEARING HOLES

The part machined caps can then be fixed in position, I tend to use cap head screws during construction only changing to studs and nuts on final assemble as they are quick and easy to use particularly if you have ball ended hex drivers. The pedestals are cast a bit wider than the 6mm caps so use a file to blend them into the caps, **photo 9**. If there is a large difference then clamp the bedplate back onto the mill and use that to remove the bulk of

the unwanted metal down to a depth of 6mm below the joint line and then feather in the resulting step by filing.

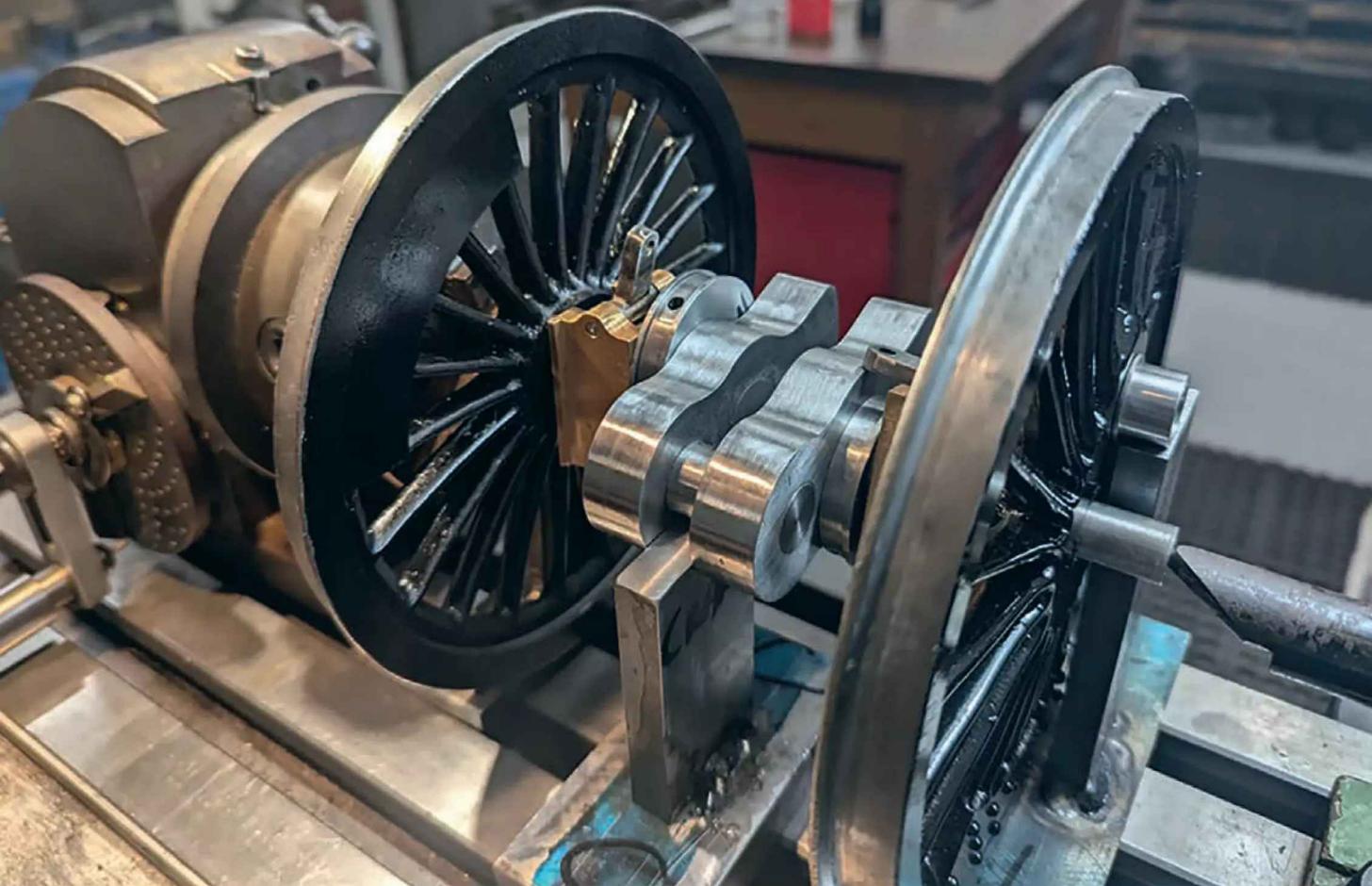
Mount the casting on its side and place packers under the edge where you previously marked the position of the buttons and pick up the centre line scribed onto the pedestal to locate the lengthways position and with an edge finder locate the joint line and lock the table. Refit the caps and start the bearing hole with a spotting drill before using a twist drill of the same diameter as the spot drill's shank to drill through the upper pedestal. Change back to the spotting drill and with it passing through the hole start the lower holes position and then open up again, **photo 10**.

Follow this up by increasing both holes to 10mm reaming size which can be 9.7-9.8mm and then run a reamer through to finish the holes to size, **photo 11**. Before removing the caps mark them and the pedestals so that they can be replaced in the same position, I tend to use a single punch mark on one pair and a double mark on the other.

The last job on the caps is to file the arched top edge, this can be done with the aid of a "washer" turned to the 17mm diameter and drilled 10mm so it can be located with an off cut of 10mm diameter bar. Hold in the vice and use the washer to guide you, **photo 12**.

To be continued

The block sets the angle of the crank pin relative to the shaft held between centres.



Setting Locomotive Wheels

James Stanton uses the 'height block' method to set the wheels of his locomotive *Galatea* to the correct angles to ensure free movement of the connecting rods.

When I was building my A4 locomotive I made a wheel setting jig according to Don Young's design. It took some time to make and was a tricky thing to set up and use. I had to push on side plates with the axle suspended in between while Loctite was going off. I was not looking forward to having to make another one for *Galatea* (An L.M.S. *Jubilee* 4-6-0 locomotive in 5

in. gauge, described by A. W. Allcock starting in *Model Engineer* issue 3798, vol. 159 in 1985).

It was suggested to me to use the bed of the milling machine, holding the shaft between centres and using blocks to set the crankpins in the correct relative positions. I had done *Juliet's* wheels in the lathe and that was easy to do, and so, with an indexing head and tailstock available, I knew this



Photo 1: The third piston requires a central offset pin on the crankshaft.



Photo 2: CAD was used to determine the heights of three blocks, one for the central crank throw and one each for the left and right crankpins.



Photo 3: The first step was to set the right-hand wheel on the crank axle, relative to the centre throw.

was the way to go. To begin with I did a drawing in Autosketch.

Knowing the height of the indexing head, the offset of the crankpin and the diameter of the crankpins I had my heights. Being a three-cylinder, **photo 1**, the cranks needed to be set to 120 degrees, rather than the typical 90 degrees of a two-cylinder locomotive. The A4 was actually 120, 126 and 114 degrees due to the angle of the inside cylinder. This one was much more straightforward. I did get my drawing checked just to make sure I didn't have any errors.

I needed three risers. Two for the outside crankpins and one for the



Photo 4: Completing the crank axle by fitting the left-hand wheel.



Photo 5: The driven wheels only require the angles of the wheels to be set.

inside crank shaft. These were made of steel from the scrap box, welded up and then milled to the correct height, **photo 2**. Once these were made, I did a trial run to familiarise myself with the process. I then used Loctite to fix the

drivers and trailing wheels on one side.

On a Friday, with the help of Ange, we started the final setup. The crank axle was first with the right-hand wheel, **photo 3**. An hour later the left wheel was done, **photo 4**. Then the drivers and trailing wheels followed, **photo 5**. It was easy. Put the axle between centres. Apply the Loctite, slide wheel up to the step on the axle and hold the wheels crankpin against the riser. Rinse and repeat with all wheels.

At 3pm everything had set for at least two hours, so it was time to put the rods on. Yes, I was nervous. However, the rods went on perfectly. And without any adjustment to the bushes, it rolls perfectly. I now have a rolling chassis, **photo 6**. 🎯



Photo 6: The rolling chassis was free-running with connecting rods fitted.



Photo 1: A Standard Beaverette Mk. III at the Imperial War Museum in Duxford, credit: Max Smith.

A Standard Beaverette in 1:12 Scale

Neil Wyatt shares an Alibre Atom 3D Project that illustrates some of the potential offered by this powerful 3D CAD system for hobbyists.

This project is, unashamedly, almost entirely composed of 3D printed parts. I have a box with about 75% of a 3D printed *Mark V light tank* inside; before completing this complex project, I wanted to 'prove' some of my ideas with a smaller, more straightforward project. I hope this overview will be useful in inspiring anyone who is thinking of trying the six-month free trial of Alibre Atom 3D. For details of this and related offers and information see page 72.

Part of the appeal of the *Beaverette Mk. III* is that the full size is essentially just a lot of flat plates, **photo 1**. In the early days of the Second World War, the need was identified for large numbers of easily made armoured vehicles, the Standard Motor Company had a large number of chassis for large

cars that were now just in storage, and these were converted into a simple armoured car by adding an open-topped box structure, retaining two bulbous wings over the front wheels. Once the chassis ran out, a more enclosed design was made with a shorter custom chassis and a basic 'turret' for a machine gun – or even a Boulton Paul turret as used on the unique *Defiant* fighter. Forward visibility for a drive a few feet behind a foot-wide 'window' was appalling, and a final version had a revised superstructure and a tall, open turret with two machine guns. The various models of *Beaverette* were used by the Home Guard and the RAF for 'point defense'. One destroyed an FW 190 that landed on a RAF airfield and then tried to take off again. A few were

exported and a similar design was built in New Zealand.

DESIGNING IN ALIBRE ATOM 3D

This was my first project where I made really extensive use of assemblies of parts to help me ensure the final 3D prints would fit together. It also made 'solving' some geometrical challenges a lot easier.

I used full-size measurements, entering values in inches; I default to mm so if I type in 4, I get a 4mm dimension, but type in 4" and it automatically converts it. I 3D printed the model at 1:12 by scaling all the parts to 8.33%. For anything I needed to be a metric dimension (e.g. to fit the ball races) I would type in a formula such as 10x12, so that when printed it would come out right. This made it easy to mix both full size and final size in the same CAD model. I'm starting to make better use of how Alibre allows use of formulas and constants. For example, in hindsight I could have referenced all my 'window cutouts' to the dimensions of the first one. Then when I had to enlarge them all by the same amount, I would only have needed to change the first one.

RUNNING GEAR

My design started around the feasibility of 3D printed running gear. I found a design for a differential on Thingiverse.com, part of the Open RC project, in this case a revision by Barspin (Daniel Noree), **photo 2**. It's intended to fit into a buggy chassis, but I was able to adapt it to fit into a differential casing designed in Atom 3D by using different half-shafts, **photo 3**. By using miniature ball races at either end of the drive shafts and a short shaft for the differential gears the only 3D printed surfaces running together are the gear teeth. Although over-scale, it would be hidden on the model. Once printed and assembled (I used holes about



Photo 2: The version of the Open RC differential I used, it actually only uses two bevel gears. To function it needs to be in a frame or case with the input and output shafts aligned in ball races.



Photo 3: My housing to take the differential and new drive shafts. The ball race for the input shaft is visible, all bearings are a push fit.

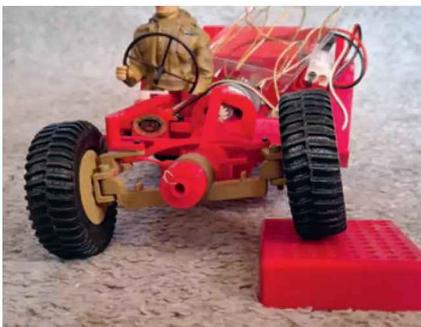


Photo 4: The simple suspension works well. Alibre made it easy to design a small amount of toe-in into the steering geometry.

0.25mm undersize with small metric screws, M2 and M2.5) it worked freely. Encouraged by this I embarked on the project properly.

Items such as the wheel hubs were straightforward to design, the only points of note are that the use of the bevel and fillet functions are very

useful to create the look of cast and pressed parts. I had to revise the drive shaft joints to use square peg and hole joints as otherwise the screws could loosen under load.

For suspension, I had planned to print relatively thin 'leaf springs' but I decided if they were flexible enough, they would be too fragile. I designed over-thickness springs for the rear axle, effectively making it rigid. For the front axle, I simply added a large diameter (13mm) pivot and a couple of stops. Obviously in the real world this would play havoc with the steering geometry whenever you went over a bump, but for a model it keeps four wheels on the ground, **photo 4**, and using a long connecting rod for the servo to steering linkage seems adequate to avoid any issues.

The front axle has simple pivoting stub axles at each end, each of which has a ball race for the wheel hub. One axle has a single steering arm, the other two, one is for the servo link. These pivot on M2 screws which cope fine with the gentle progress of the model.

The tyres were more of a challenge, they needed a very heavy tread. My solution was to draw a cross section of the 'core' of the tyre and used the boss rotate command to fill it out. I then created a single tread and used the 'circular pattern' command to create many copies around the axis of the tyre, then mirrored them to the other side. It's worth remembering that Alibre allows you to 'overlap' sketches within a part, that helps make sure you don't end up with unexpected gaps in the final result.

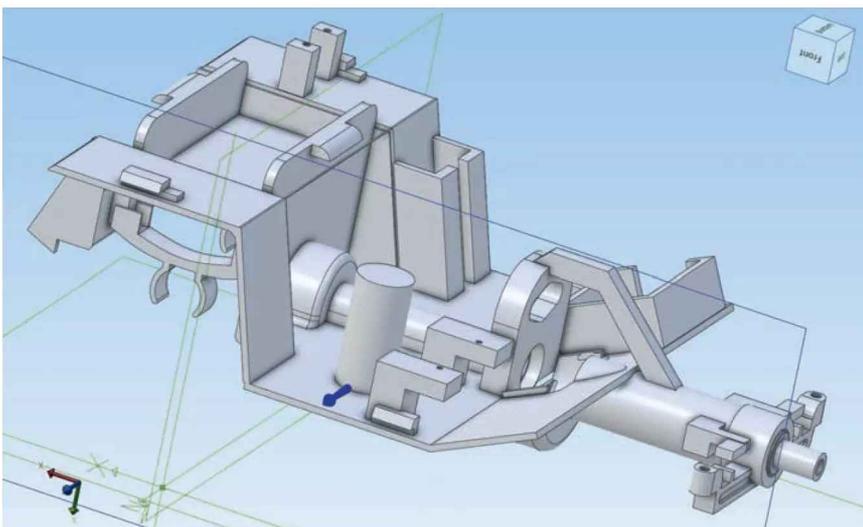


Photo 5: The chassis assembly with the rear springs, a gear shield and the front axle assembled to it in Alibre. It is very easy to add on mounting points and 'trays' for various items so they print as a single part.



Photo 6: The finished chassis, integrating parts reduced printing time and made assembly a doddle.

Most of the model was printed in PLA, but for the tyres I used TPU, which can be a bit tricky to print but I got a really nice result, perhaps a little shiny, but with just enough give to work well.

THE CHASSIS

All this 'running gear' is mounted on a 3D printed chassis, **photo 5**, which includes mounting points for an electric motor and a ball-raced 3D printed main gear (which connects to the differential via a 3D printed drive shaft. Because of its small size, and as it was already fitted to the motor, I retained the small pinion on the motor. For most applications (such as buggy racing) the motor would directly drive the differential, giving about 3.5:1 reduction, and you might use a rather more powerful and higher revving motor. The Beaverette had a top speed of just 24mph, so a scale speed of only 2mph meant an extra stage of reduction was useful.

The final iteration of the chassis, **photo 6**, also included the servo mount, and 'trays' for the radio receiver, speed controller, power switch and a Lipo battery. There was also a pillar on which the 'driver' could be fitted and four simple clips to secure the body.

That's quite a lengthy description, and it took a fair bit of work to come up with the design in Alibre. I made an 'assembly' of key parts the chassis, differential, springs and front axle, which greatly helped with making sure I had adequate clearances. I still ended up printing a few trials, because although Alibre will tell you a gear will fit, it won't tell you the space you left for fitting it is too narrow, or how much you need to add to the centre distance to ensure free running of gears. I solved the latter issue by 'extruding' a hollow rectangle to isolate the motor/gear mount alone (I could also have suppressed parts of the chassis, but that would have taken

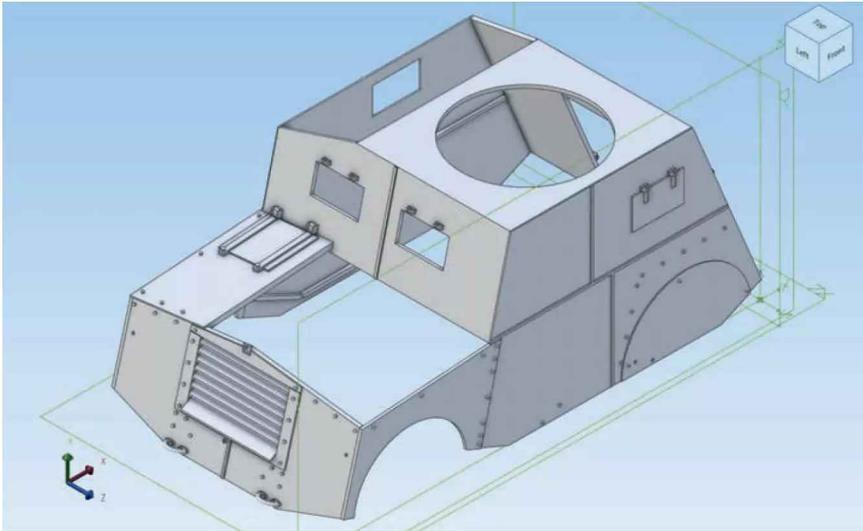


Photo 7: The body shell, partly assembled. Items that are repeated, such as window flaps only need to be created once.

longer) and printed a few until the motor and gear mated freely. I also had to add a long hole down the steering pivot, this allowed me to insert a screwdriver to fix the main gear to the end of the driveshaft.

THE BODY

Making the body was an entirely different challenge, where an accurate appearance and optimising it for a good quality 3D print were the most important considerations.

I decided to make it an assembly of several parts, **photo E**. It's asymmetrical so I designed one side, then made a mirror copy which I edited to make the second side, for example. I could have made realistic rivets by rotating quarter-circles, but at this scale simple cylinders look just as good and massively reduce the load on the computer when redrawing the model. Similarly, for raised weld lines I just drew narrow outlines and extruded them.

I started the assembly with the left side, then added the short extension over the left wheel arch. Next was the back panel, to which I assembled the right side and wheel arch extension. I found the most useful way to constrain these parts was to start by linking the two mating faces, then choosing an edge on each part that lined up. I feel there's as much art as science when assembling this sort of part in contrast to a working mechanism where the assembly is more obviously defined.

Once I had this basic 'U-shaped' body I created the remaining body panel as parts in the assembly. This ensured they would be a good fit.

Make sure you give these new parts meaningful names when Alibre asks you to save the for the first time. If you rename them, it won't know where they fit. This approach made getting the angled 'windscreen', radiator and bonnet covers the right size relatively easy as I didn't have to measure them. I made bevelled joints (e.g. the bonnet flaps to windscreen) by creating the parts affected (the bonnet ends and hinge parts) over length so they overlapped with the 'windscreen', then drawing an overlapping rectangle 'on' the windscreen and extruding it as a cut to remove the excess material. It's easier to do than describe!

I discovered a big advantage of the assembly approach when it came to printing the model. Just under a foot

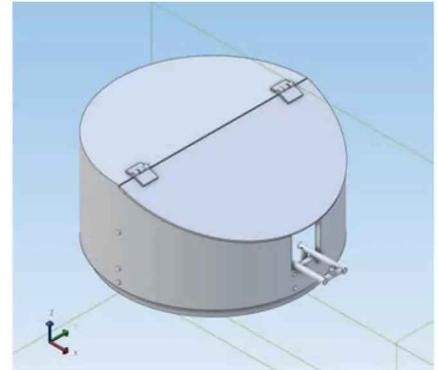


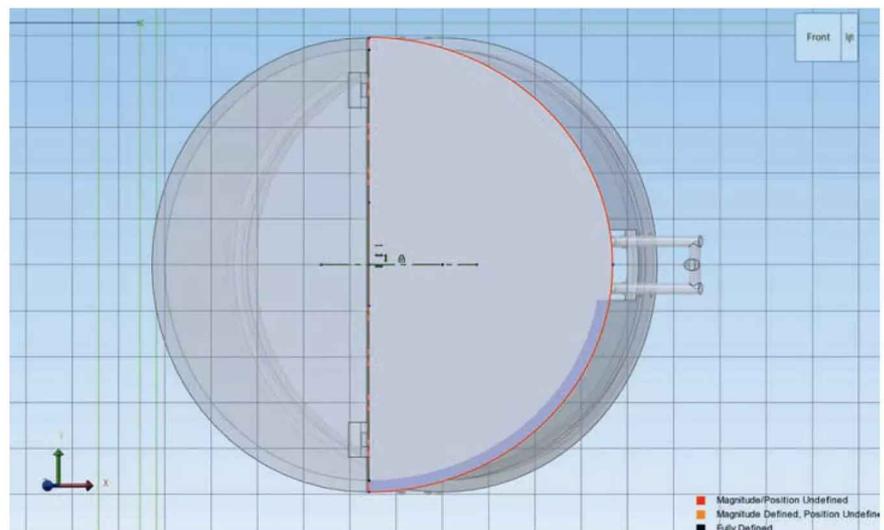
Photo 8: Deceptively simple, the turret needed a lot of tuning to get an accurate appearance.

long the body shell fitted on the bed of my Creality K1 Max, but the shallow slopes of the roof and bonnet resulted in nasty artefacts in the form of shallow steps. By excluding these from the assembly and printing them separately with their top surfaces horizontal, I was able to get a respectable finish on all parts.

I worked out that 3D printers ought to be able to avoid these lines by raising the nozzle when printing gradual slopes to avoid creating steps. Apparently, there are some experimental slicers that can now do this.

THE TURRET AND OTHER DETAILS

The turret, **photo 8**, caused a lot of grief. Online drawings are inaccurate; I had to make it bigger and realised the 'flap' is a single flat piece and not with a significant bend, **photo 9**. Much squinting at photographs



The 'edit in place' option made it easy to create the half-elliptical shape of the turret flap to be a close fit on the angled face of the turret. Locked guidelines fix the centre of the ellipse.



Photo 10: The face in the turret will be familiar to many readers, scanning poseable action figures is a way to create realistic figures if you struggle with modelling organic shapes.

was needed to visualise the hinge arrangement. Unlike the turret flap, the window flaps and rear door these use a simple blade that slots between two uprights. Handily this allows the parts to be glued in either an open or closed position.

The Bren machine gun is a design by 3D-mon from Thingiverse; I broke off the bipod legs and reglued them in a folded position. I was going to use my own design for a Lewis gun, but I couldn't find any contemporary photographic evidence for their use on the Beaverette.

The headlamp and sidelights were designed in Alibre. 1mm diameter holes in the bottom of them allowed me to use short lengths of electric cable to 'connect' them. In theory I could fit an LED in the headlight. Finally, I scanned an 'Action Man' in two suitable poses for the Driver and Gunner using the Creality Scan Ferret. The chap in the turret had a bit of surgery to his back and is glued to the inside of the turret, **photo 10**.

The turret just sits in a hold in the roof of the body shell. It can be lifted off to switch the electronics on and off.

THE FINISHED RESULT.

Initial trials with a two Lipo battery pack were a bit disappointing as it was very slow. The motor I used is very low-revving, I think it's intended for 18V or 24V use in a computer printer. A three-cell pack worked



Photo 11: The aerial, loosely coiled around a piece of plastic.

as the aerial is coiled inside the body (I don't want an external aerial). It was improved by coiling the aerial loosely around a plastic former, **photo 11**.

I painted the model using acrylics and printed my own decals using white decal paper. I added a coloured background to the numbers and trimmed closely, but it needed hand retouching as the colour match wasn't perfect. It's not perfect but I think it compares well to the original, **photo 12**.

My Alibre files open the possibility of getting panels laser cut and making a metal 1:6 scale version in the future. I'm also thinking of making a few minor tweaks to create a 1:35 scale static version. Perhaps the most tempting possibility is designing the Boulton Paul Turret and perhaps getting PCBway to print it in clear resin.

This has been a fun project, I hope to bring my little armoured car to MMEX this year – please don't tread on it! 🐾

better, with a top speed of about 3 mph, a gentle walking pace. The large 3D printed gear is a little noisy, but it sounds a bit like an engine running. Steering is responsive, but the steering circle seemed a bit large at about a meter – I looked it up and this is to scale! The simple suspension works very well and looks surprisingly realistic. Radio control range with a venerable two-channel unit is modest,



Photo 12: The finished model

WE ARE THE EXCLUSIVE UK DISTRIBUTOR FOR

WABECO

MACHINE MANUFACTURER since 1885

 **Made in
Germany**

**5
YEARS
WARRANTY**

*On selected
machines*



Wabeco milling machines
Prices from £3,799.00



Wabeco drilling stands
Prices from £238.00



Wabeco lathes
Prices from £3,795.00

Prices include VAT & Delivery Mainland UK

**We offer a complete range of quality, precision
machines for the discerning engineer.**

Developed and manufactured in Germany, Wabeco products guarantee the highest quality standards. Whether your milling or drilling with Wabeco, you're sure to get the best results possible.

Emco distributes a wide range of machine tools, CNC Machines, Lathes, Mills, Routers and Waterjet cutters for industrial and education use.

Visit emco.co.uk to see the full range of new and used machines
or call us on 02392 637 100 for more details.



isel **WABECO**
MACHINE MANUFACTURE SINCE 1885

Emco Education Ltd, Unit 4, Hayling Billy Business Centre, Furniss Way,
Hayling Island, Hampshire, United Kingdom PO11 0ED sales@emco.co.uk

emco
UK DISTRIBUTOR

Vibration, Sound and Noise

This short series by **Rhys Owen** explores the phenomenon of ‘vibration’ and how science can answer some unusual questions.

PART 1

“...riding on this engine I can only compare to sitting on a galvanic battery with the noise of a boiler shop thrown in.” Extract from a locomotive driver’s report.

In 1982, after some months spent in the - then little-known - Chinese city of Wuhan, I had a memorable trip on the mountainous railway line from Datong to Taiyuan. The train was hauled by a QianJin class 2-10-2 steam locomotive and, as the train laboured up one of the many gradients, I saw the heads of my fellow-passengers begin to rock back and forth – an interesting phenomenon! But why did this happen at that particular time?

Here are some more questions to consider:

- Why is the interior of a bus that is ‘ticking over’ at a bus stop usually noisier than when the bus is running at speed?
- What is the science behind the activities of the railway wheel-tapper – and what is the modern equivalent?
- The drum of a washing machine wobbles when you push against it. Clearly the drum is not rigidly attached to the body of the machine – but why not?
- Some years ago I went to a talk in a church hall – the subject was interesting but why was it agony to listen to?

The above matters all relate in one way or another to vibration. The

vibration of the air that we detect in our ears is called sound. To quote the website of the Institute of Acoustics, “Acoustics is the interdisciplinary science that deals with the study of all mechanical waves in gases, liquids, and solids including vibration, sound, ultrasound and infrasound.”

Noise is usually defined as unwanted sound (“one man’s symphony is another man’s cacophony!”).

FREE VIBRATION WITH NO DAMPING

Much can be learned from the behaviour of a mass (such as a bunch of keys) hanging on the end of a spring (for example, a string of connected rubber bands). This is as close as we can easily get to an undamped mass-spring system operating in one dimension only (i.e. with a single degree of freedom). But even such a system is affected by damping (the air resistance) and the case of an undamped mass-spring system is, effectively, never found.

Ignoring damping for a moment, such a single degree of freedom mass-spring system looks like **fig. 1** for a vertical system, or like **fig. 2** for a horizontal one.

In both cases, we are looking at the effect of a displacement of the mass-spring system from its equilibrium position and it will be found that, in the vertical version, gravity makes no difference.

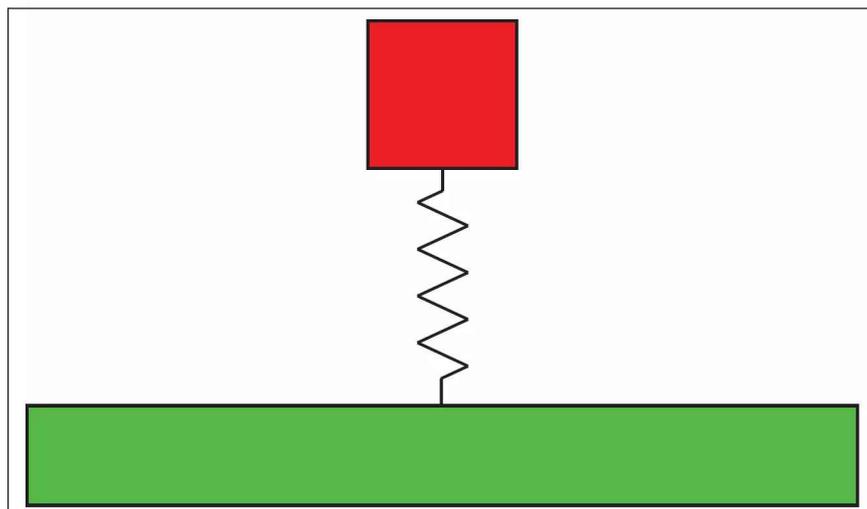


Figure 1, Mass-spring system (vertical orientation)

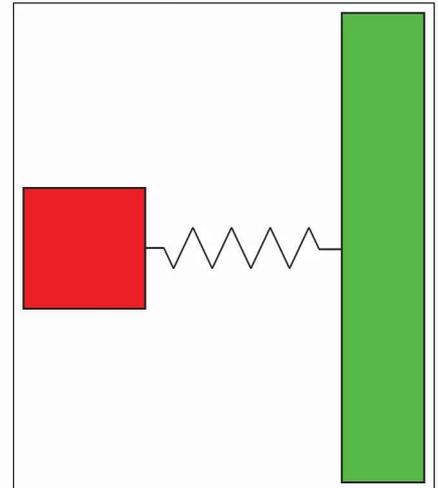


Figure 2 Mass-spring system (horizontal orientation)

According to Hooke’s Law, within certain limits, the extension (or compression) of a spring from its relaxed (or ‘unstretched’) state is proportional to the force exerted on it. If we extend or compress the spring, then the spring will exert a force that opposes that extension or compression. This force will be proportional to the displacement and act in the opposite direction to it.

Mathematically, the force (F) exerted on the mass (m) by a spring of a given stiffness (k) when displaced a distance (x) is given as follows:

$$-F = kx$$

Here the minus sign on the left hand side of the above equation indicates that the force acts in the opposite direction to the displacement.

Newton’s Second Law of motion states that the rate of change of momentum of a body is equal to the resultant force applied to it. Where the mass of the body is constant this means that the force (F) is equal to the mass (m) multiplied by the acceleration (a), that is:

$$F = ma$$

If we substitute this into the earlier equation, we get:

$$-ma = kx$$

If we add ma to both sides of the above equation, we get:

$$ma - ma = ma + kx$$

Giving:

$$0 = ma + kx$$

Or, by swapping sides:

$$ma + kx = 0$$

In this case $x = 0$ at the initial position of the mass when the spring is neither in tension nor compression.

Note that the above assumes that the mass of the spring itself is negligible.

Acceleration is the rate of change of velocity with respect to time, and velocity is the rate of change of displacement with respect to time. It follows that acceleration is the rate of change of the rate of change of displacement with respect to time. So we need to look for a displacement function, in this case a "recipe" for displacement "x" whose main "ingredient" is time, whose properties allow the above equation to be true (a more formal treatment would consider the initial conditions, but these are not important here).

A simple solution to the above is the following sine function:

$$x = x_0 \sin \omega_n t$$

Where:

- x is the displacement from the initial position.
- x_0 is the maximum displacement,
- ω_n is the natural angular frequency defined in radians per second,

• t is time.

We will find that, for an undamped mass-spring system:

$$\omega_n = \sqrt{\frac{k}{m}}$$

In everyday life we use degrees to measure angles but the SI measure for angles is the radian. One radian is that angle which, when subtended from the centre of a circle, intercepts an arc in that circle equal in length to its radius. This means that a whole rotation (360°) equals 2π radians and one radian is a little less than 57.3° .

Returning now to the formula cited above:

$$x = x_0 \sin \omega_n t$$

Plotting this where $x_0 = 1$ is the same as plotting the sine function as in the graph in **fig. 3**:

We can see from the oscillation of our mass-spring structure that at the mid-point of the oscillation (where the spring is in its equilibrium position) the displacement is zero but the velocity of the mass is at a maximum. At this stage the acceleration will be zero (this follows from the $ma+kx=0$ equation - if x is zero, since m and k are not zero, then it follows that a must be zero).

However, at maximum displacement (x_0) the force exerted by the spring will have reduced the velocity to zero. Since the spring is at its maximum extension (or compression) the force it exerts will be at its maximum and (because $F = ma$) the acceleration will be at its maximum but directed back

towards the equilibrium position. This is a typical example of what is called simple harmonic motion.

As stated earlier, it can be shown that, at any given time t , the displacement x will be given by the function:

$$x = x_0 \sin \omega_n t$$

This assumes that $x = 0$ when $t = 0$.

Then the velocity of the vibrating body will be given by:

$$v = x_0 \omega_n \cos \omega_n t$$

The acceleration will be given by:

$$a = -x_0 \omega_n^2 \sin \omega_n t$$

In mathematical terms, the differential calculus has been applied to the displacement as a function of time to obtain the velocity and the process has been repeated to obtain the acceleration.

Since one cycle or turn (360°) is 2π radians, it follows that:

$$f = \frac{\omega}{2\pi}$$

In case you are losing track of the symbols, this can be expressed in words as follows:

$$\text{Frequency} = \frac{\text{Angular frequency}}{\text{Number of radians in a whole turn}}$$

It follows that, for the natural frequency:

$$f_n = \frac{\omega_n}{2\pi}$$

Since:

$$\omega_n = \sqrt{\frac{k}{m}}$$

It follows (because a whole turn is 2π radians) that:

$$f_n = \frac{1}{2\pi} \sqrt{\frac{k}{m}}$$

So, it is possible to calculate the natural frequency of an undamped mass-spring system if we know the mass and the stiffness of the spring. This is not important if we are looking at a bunch of keys on spring made of elastic bands, but it is vitally important for an engineer who is trying to control the vibration of a car engine or of an item of building services. Let us look at an example:

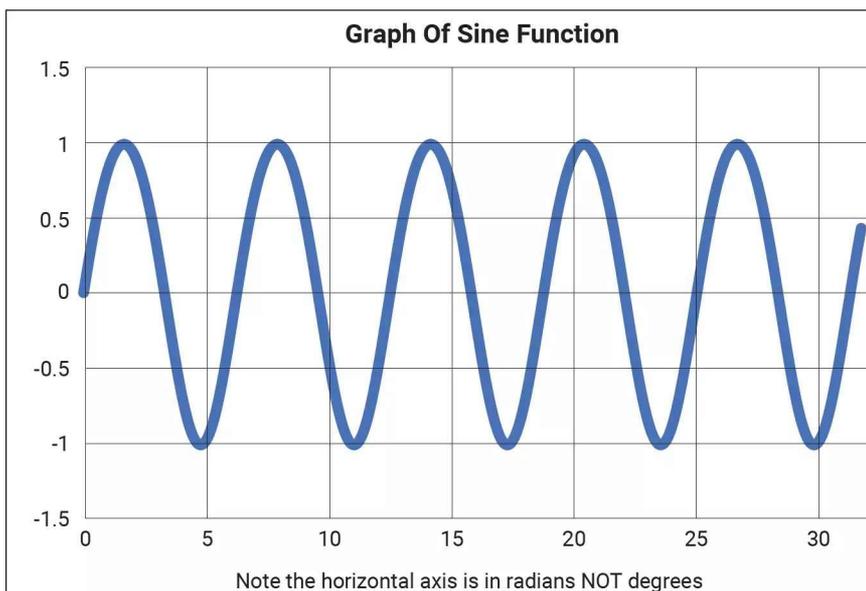


Figure 3 Graph of Sine Function

EXAMPLE 1

When placed on its spring mounts a machine pushes those mounts down by 10mm. What is the natural frequency of this mass-spring system?

SOLUTION

To work this out we need first to ensure that we are using consistent units. So we express 10mm as (10/1000=) 0.01m (here m stands for metres).

If we knew the mass of the machine, we could find the value of k from the mass of the machine and the distance it pushes the mounts down. In fact, in this case we do not need the mass as it will be cancelled out in the calculation. For the moment we shall call the mass m , carry on and see what happens...

The force exerted on the springs by the machine is the machine mass multiplied by the acceleration:

$$F = ma$$

Here the acceleration is gravitational acceleration ($a = g \approx 10 \text{ ms}^{-2}$) giving a force of ($m \times 10 =$) $10m$ newtons.

If a force of $10m$ newtons pushes the mounts down by 0.01m (remember, this latter "m" stands for metres!) then the stiffness of the mounts is given by:

$$k = \frac{10m}{0.01} = 1000m \text{ newtons per metre}$$

We now substitute this value into our frequency equation and find that the m values cancel each other out:

$$f_n = \frac{1}{2\pi} \sqrt{\frac{k}{m}} = \frac{1}{2\pi} \sqrt{\frac{1000m}{m}} = \frac{1}{2\pi} \sqrt{1000} \approx 5 \text{ Hz}$$

We now know that the natural

frequency of the mass-spring system is about 5 Hz (i.e. 5 cycles per second). This will be useful later on (after we look at the effect of damping).

The fact that the masses m cancel out within the square root sign in the equation above means that a building services engineer can obtain the natural frequency of a mass on its machine mounts just by measuring the amount δ mm by which the machine pushes its mounts down and applying the following (equivalent) formula:

$$f_n = \frac{15.8}{\sqrt{\delta}}$$

In this case δ is input into the equation in **millimetres** not metres!

DAMPING

Damping is defined as something that reduces or prevents oscillation. Real-life mass-spring systems lose energy, usually through some form of friction. The effect of damping is usually proportional to velocity so that our mathematical model becomes:

$$ma + cv + kx = 0$$

The solution of this equation depends upon whether the damping is critical, less than critical or greater than critical.

In the case of less than critical damping, when moved from the equilibrium position and released (such as a harp string being plucked) the system oscillates but with gradually decreasing amplitude.

In the case of greater than critical damping, when moved from the equilibrium position and released the system does not oscillate. When the

mass is moved from its equilibrium position it returns gradually back to the equilibrium position (e.g. an overhead door closer).

Critical damping is the boundary between the above two types of damping, that is, the system returns to equilibrium as fast as possible without overshooting into oscillation.

Critical damping occurs when the damping is at the critical damping coefficient c_c which is given by:

$$c_c = 2\sqrt{km}$$

We are usually interested in ζ (zeta), the fraction of critical damping:

$$\zeta = \frac{c}{c_c}$$

When ζ is less than one ($\zeta < 1$) then the system oscillates and this is the situation that is of interest.

Mass-spring systems with damping are very common. Motor cars are fitted with springs and viscous dampers (although these are known as shock-absorbers). The leaf springs used in the suspension of most steam locomotives have intrinsic damping because of friction between the spring leaves.

FORCED VIBRATION

So far, we have looked at free vibration, finding the natural frequency of the system and seeing the effect of damping. However, most vibration occurs in response to a cyclical excitation. Typical examples occur in building services where devices such as fans and pumps are normally mounted on springs. The domestic washing machine normally has a spring system that mitigates the effects of the washing within the drum being out of balance when the drum rotates. In most cases the one-dimensional mass-spring model is a simplification as rotating forces complicate matters. But we shall only look at the simple mass-spring system with damping as this illustrates general principles.

In the diagram, **fig.4**, a damper has been added (I understand that the symbol is based on a dash-pot damper).

This cyclical excitation is usually assumed to be sinusoidal (i.e. like a sine wave) although this is often a simplification. In the case where there is no damping this gives the following equation:

$$F_0 \sin \omega t = ma + kx$$

Where the excitation force is F_0 and this force oscillates with angular frequency ω .

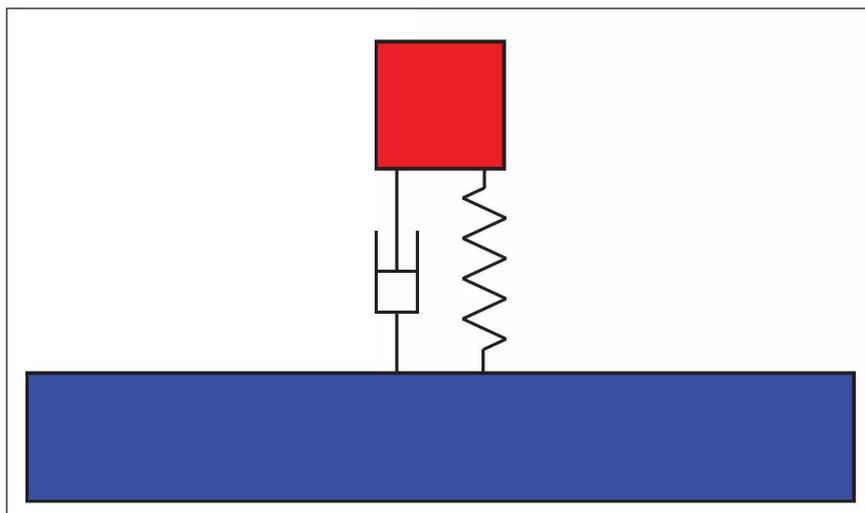


Figure 4 Mass-spring system with damper

Some mathematics (which we shall skip over!) gives the following equation for the steady state:

$$x = \frac{F_0/k}{1 - \omega^2/\omega_n^2} \sin \omega t$$

We can see that

- F_0/k will be constant.
- $\sin \omega t$ will take values between -1 and 1 (we could write this $-1 \leq \sin \omega t \leq 1$).
- Interesting things happen as f approaches f_n !

To elaborate on the last point, let us look more closely at the lower part of the above equation, which is:

$$1 - f^2/f_n^2$$

We can see that when $f = f_n$ the above expression will equal zero. This makes the preceding displacement equation indeterminate and we cannot evaluate x (because the lower part of the equation will equal zero and dividing by zero has no meaning).

However, when the forcing frequency (f) is close to the undamped natural frequency of the system (f_n) then the lower part of the steady state equation will be very small. This will make the extreme values of the displacement x very large. These extreme values occur when $\sin \omega t$ is 1 or -1.

The above mathematical model is much the same whether the system is activated by an internal force within the mass or by an external force. An example of the former is in the case of a car engine acting on the car chassis. An example of the latter is a tractor driver who will be less affected by the tractor's vibration if the tractor seat is mounted on springs.

In real life, mass-spring systems are constrained in some way, either by damping or by some physical limitation. Accordingly, we shall now look at the case of forced vibration with damping where the mathematical model is:

$$F_0 \sin \omega t = ma + cv + kx$$

It can be shown that:

- The steady-state response (when things have settled down - as opposed to the transient, initial, response) of this type of forced, damped, system is independent of the initial conditions.
- The system's response occurs at the same frequency as that of the cyclical excitation. This is ω radians per second or $(\omega/2\pi) = f$ cycles per second.
- The response of the system is not in phase with the oscillating force

(because of the damping).

This can be seen if we return to our simple model of a bunch of keys suspended on a spring made of elastic bands. If a hand applies an oscillating force to the spring (i.e. flaps it up and down regularly) then, if the hand movement is slow, the bunch of keys will almost mimic the movement of the hand, although with a slight lag.

As the hand movement becomes faster, then the lag becomes greater until, eventually, the natural frequency of the system is reached and the bunch of keys dances about wildly.

If the frequency of the hand movement is increased still further then the movement of the keys becomes calmer and, as the frequency of the hand movement increases, so the motion of the keys becomes progressively smaller in relation to the movement of the hand.

At a hand movement frequency below the natural frequency of the system, the movement of the keys is in the same direction as that of the hand (apart from the slight lag mentioned above). However, at a hand movement frequency above the natural frequency, the opposite is the case - in other words, when the hand moves up the keys move down (again with a slight lag) and vice versa.

The mathematical model of a mass-spring system subject to a cyclical force is something that we shall skirt around but three main regions can be identified, these being:

1. The stiffness-controlled region

This is the region where the frequency of the cyclical force is much less than the natural frequency of the system.

Essentially, the mass mimics the movement of the cyclical force but there is a slight lag between the action of that force and the response of the system.

The response will decrease as the stiffness increases - which is what one would expect.

2. The damping-controlled region

This is the region where the frequency of the cyclical force is very close to the natural frequency of the system. In this region increasing the damping in the system will decrease the value of the displacement of the mass. This means that the response of the system at, or close to, the natural frequency of the system is controlled by the damping which is why this region is "damping-controlled". Increasing the damping of the system **reduces** the response of the system in this region but, at frequencies above $1.414 f_n$ (i.e. $\sqrt{2}(f_n)$), increasing the damping has an unfortunate result as we shall see.

Not only does the damping decrease the response of the system but the damped natural frequency of the system will be lower than the undamped natural frequency.

When there is little damping in the system and the forcing frequency is at, or close to, the system's natural frequency then the vibration amplitudes become very large. This phenomenon is called resonance and is desirable for musical instruments. For most structures and machines, however, it is undesirable. Essentially, with little damping, the situation is almost the same as that shown in the undamped system when the frequency of the oscillating force approaches the natural frequency of the system.

3. The mass-controlled region

This is the region where the frequency of the cyclical force is much greater than the natural frequency of the system.

In this case increasing the mass will reduce the displacement (this is why washing machines are heavy!).

In the stiffness-controlled region the mass is roughly in phase with the cyclical force but this progressively changes as the frequency changes so that in the mass-controlled region the mass is essentially moving in the opposite direction to the cyclical force. In practical terms the phase change is of little significance. Indeed, in most cases neither the phase changes nor the initial conditions are of interest.

Mathematical models of such systems are of considerable use to practical engineers who are interested in how vibration is transmitted from one part of the system to another. Examples include:

- The engine mountings of an internal combustion engine.
- The mountings of the various components of ventilation systems.
- The drawgear of a railway locomotive (especially of a reciprocating steam locomotive).

The foregoing are examples of continuous vibration, but transient vibration can also be a problem. For example, a train passing by a house will cause transient vibration and buildings are sometimes mounted on isolators to mitigate this phenomenon.

Let us now look at transmissibility T , which, in the case of a mass such as a machine mounted on a foundation, is the ratio of the force transmitted out of the machine (F_0) to the force transmitted into the foundation. That is:

$$T = \frac{\text{Force transmitted}}{F_0}$$

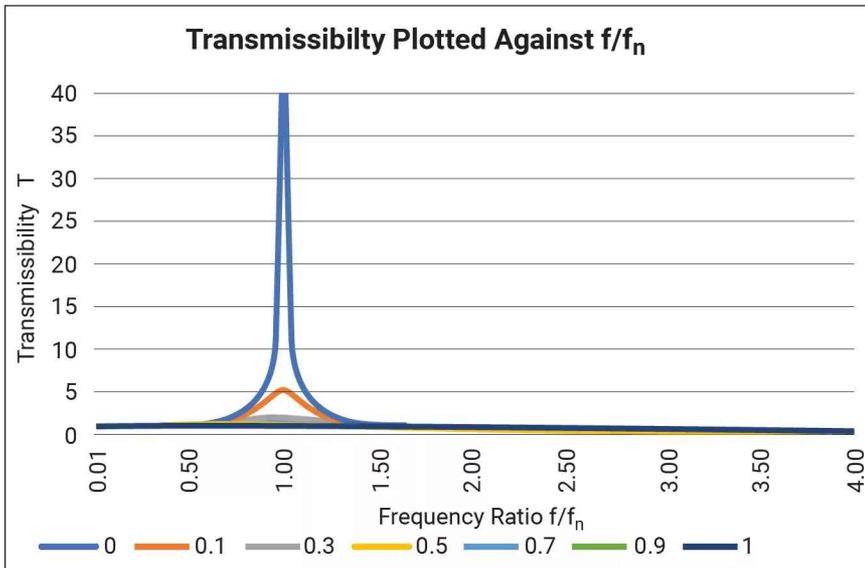


Figure 5 Transmissibility graph

We can see this if we plot, **fig. 5**, the transmissibility against f/f_n for various values of ζ (zeta), which, as mentioned earlier, is the fraction of critical damping:

$$\zeta = \frac{c}{c_c}$$

The values at the bottom (0, 0.1, 0.3, 0.5, 0.7, 0.9 and 1) are the various values of the damping ratio ζ , which is the ratio of the damping to the critical damping ($\zeta = c/c_c$).

The above graph is not easy to read. Matters become clearer if, instead of plotting the transmissibility against the frequency ratio, we make the vertical axis logarithmic, **fig. 6**.

We can see from the above graph that increasing the damping reduces the transmissibility at the system's natural frequency. However, increasing the damping also means that the transmissibility is less reduced at high frequencies (when $f > 1.414f_n$). That is, above this frequency, high damping means that more vibration is transmitted than would be the case with low damping.

The damping also affects the frequency at which the maximum transmissibility occurs. The graph shows that the frequency at which the peak occurs becomes progressively lower as the damping in the system is increased.

Inspection of the above graph gives the reason why the passengers' heads started to rock back and forth as the Datong to Taiyuan train climbed to a summit. Pulses (roughly sinusoidal) of force from the steam locomotive (created by the piston thrusts as modified by the balance weights) caused vibration that was transmitted through the coupling between the engine's tender and the train. As the train slowed down on the gradient, the frequency of this vibration approached the natural frequency of the mass-spring system that consisted of the train and the coupling. The transmissibility was thus increased so that the passengers' heads rocked back and forth at the same frequency as the piston strokes.

To be continued

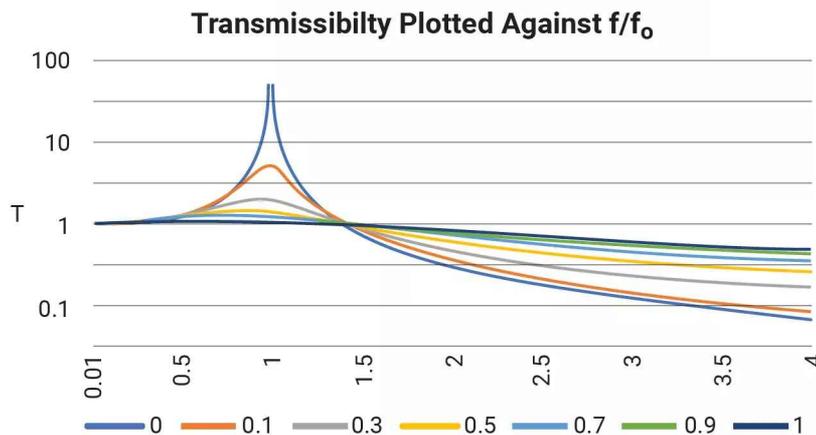


Figure 6 Transmissibility Graph (log version)

The equation that can be derived for this is rather impressive (I would say terrifying - Ed.):

$$T = \frac{1 + 4\zeta^2 \left(\frac{f}{f_n}\right)^2}{\sqrt{\left[1 - \left(\frac{f}{f_n}\right)^2\right]^2 + 4\zeta^2 \left(\frac{f}{f_n}\right)^2}}$$

If there is little damping in the system, we can assume that $\zeta = 0$ and the above expression simplifies, where $f < f_n$ to:

$$T = \frac{1}{1 - \left(\frac{f}{f_n}\right)^2}$$

Where $f > f_n$ then:

$$T = \frac{1}{\left(\frac{f}{f_n}\right)^2 - 1}$$

That is, the transmissibility is always a positive value.

If we set $T = 1$ in the last equation a little algebraic manipulation will show that there is no amplification of the force transmitted when the frequency f is $\sqrt{2}$ times the natural frequency f_n (i.e. $1.414f_n$). Below this frequency there is an amplification and above this frequency the force transmitted to the foundation is lower than the force put into the system by the machine.

As we saw in our discussion of an undamped system, when f is equal to f_n the undamped transmission formula is indeterminate. However, in any "real life" system there will be damping of one sort or another. Damping has the effect of reducing the transmissibility near to the system's resonance frequency (indeed wherever $f < 1.414f_n$). However, when the frequency exceeds $1.414f_n$ then damping **increases** the transmissibility.

SAVE £££s ON THIS WEEK'S



**PRICE
CRASH**

SEE ONLINE FOR LATEST DETAILS

Machine Mart

BRITAIN'S TOOLS & MACHINERY SPECIALIST
SELLING TO PUBLIC AND TRADE FOR OVER 40 YEARS

FOR EXCLUSIVE IN-APP OFFERS

DOWNLOAD NOW

GET IT ON
Google Play

Download on the
App Store



GARAGES/WORKSHOPS

- Extra tough triple layer cover
- Heavy duty steel tubing
- Ratchet tight tensioning



KEEPS THE WEATHER OUT!
FROM £239.98 exc.VAT
£287.98 inc.VAT

BRIGHT WHITE INTERIOR

LENGTH UP TO 40'

ZIP CLOSE DOOR

Model	Dims	Order Code	exc.VAT	inc.VAT	WAS inc.VAT
CIG81212	3.6 x 3.6 x 2.5m	140613584	£239.98	£287.98	£287.98
CIG81015	4.5 x 3 x 2.4m	140613570	£276.00	£331.20	£331.20
CIG81216	4.9 x 3.7 x 2.5m	140613574	£315.00	£378.00	£378.00
CIG81020	6.1 x 3 x 2.4m	140613572	£339.00	£414.00	£406.80
CIG81220	6.1 x 3.7 x 2.5m	140613576	£389.00	£466.80	£466.80
CIG81224	7.3 x 3.7 x 2.5m	140613578	£479.00	£574.80	£574.80
CIG1432	9.7 x 3.6 x 3.5m	140613594	£1079.00	£1294.80	£1294.80
CIG1640	12.4 x 4.3m	140613596	£2299.00	£2877.60	£2758.80

BOLTLESS SHELVING/BENCHES

- Simple fast assembly in minutes using only a hammer



FROM £39.98 exc.VAT
£47.98 inc.VAT

CHOICE OF 5 COLOURS
RED, BLUE, SILVER, GREY & GALVANISED STEEL

MILLING DRILLING MACHINES



£699.00 exc.VAT
£838.80 inc.VAT
CMD300

£549.00 exc.VAT
£658.80 inc.VAT
CMD10

• Ideal for the compact workshop

DRILL PRESSES

WIDE RANGE IN STORE AND ONLINE

FROM £84.99 exc.VAT
£101.99 inc.VAT

- Range of precision bench & floor presses for enthusiast, engineering & industrial applications

BEST SELLER



Model	Motor (W)	Speeds	Order Code	exc.VAT	inc.VAT
CDP5E	350	5	060712030	£84.99	£101.99
CDP102B	350	5	060715512	£109.98	£131.98
CDP152B	450	12	060715522	£129.98	£151.98
CDP452B	550	16	060715575	£289.00	£346.80
CDP502F	1100	12	060715592	£275.00	£310.00

B = Bench mounted
F = Floor standing

METAL LATHE

- 300mm between centres
- LH/RH thread screw cutting
- Electronic variable speed
- Gear change set
- Self centering 3 jaw chuck & guard
- Power feed



£679.00 exc.VAT
£814.80 inc.VAT



CL300M
060712525

18V BRUSHLESS COMBI DRILLS

PRICE CUT
£79.98 exc.VAT
£95.98 inc.VAT
WAS £99.99 inc.VAT

- 2 forward and reverse gears



CON18LIC
060219531

ARC ACTIVATED HEADSHIELD

- Activates instantly when Arc is struck
- Protects to EN379
- Suitable for arc, MIG, TIG & gas welding

£34.99 exc.VAT
£41.99 inc.VAT



GWH7
010120709

SEE FULL RANGE IN-STORE/ONLINE

PTC CERAMIC FAN ELECTRIC HEATERS

FROM £29.98 exc.VAT
£35.98 inc.VAT

BEST SELLER



DEVIL2800PTC-B

Model	Heat Output	Order Code	exc.VAT	inc.VAT
DEVIL 2000PTC-B	1-2kW	010415591	£29.98	£35.98
DEVIL 2800PTC-B	2.8kW	010415602	£49.98	£59.98
Devil 5000PTC	3.3-5kW	010415340	£72.99	£87.99
Devil 9000PTC	6-9kW	010415238	£129.98	£155.98

BELT AND DISC SANDER

- Belt sanding can be performed with the belt in the horizontal or vertical position
- Includes dust collection bag

£189.00 exc.VAT
£226.80 inc.VAT



C548
060611430

3-IN-1 SHEET METAL MACHINES



- Bends, slip rolls and shears mild steel sheet up to 1mm
- Max. bending angle 0-90°

FROM £289.00 exc.VAT
£346.80 inc.VAT

Model	Bed Width	Order Code	exc.VAT	inc.VAT
SBR305B	305mm (12")	051216001	£289.00	£346.80

MMA & ARC/TIG INVERTER WELDERS



WAS £119.98 inc.VAT
WAS £155.98 inc.VAT

Model	Min/Max Output Current (mm)	Electrode Dia. (mm)	Order Code	exc.VAT	inc.VAT
MMA140A	20A-140A	1.6-3.2	010112161	£94.98	£113.98
MMA200A	20A-200A	1.6-3.2	010112163	£119.98	£143.98
AT165	10A-160A	2.5/3.2/4.0	010112149	£219.98	£268.98

BENCH BUFFERS/POLISHERS

FROM £74.99 exc.VAT
£89.99 inc.VAT



- For a brilliant shine

Model	Dia. (mm)	Order Code	exc.VAT	inc.VAT
CBB150	150	060710485	£74.99	£89.99
CBB200	200	060710490	£94.99	£113.99
CHDB500	150	060710492	£119.98	£143.98
CBB250	250	060710491	£169.98	£203.98



ENGINEERS HEAVY DUTY STEEL WORKBENCHES

- Sturdy lower shelf
- Durable powder coated finish



FROM £259.98 exc.VAT
£311.98 inc.VAT

Model	Dims. LxWxH (mm)	Order Code	exc.VAT	inc.VAT
CWB1500D	1500x650x985	040317718	£259.98	£311.98
CWB2001P	2000x650x865	040317809	£279.98	£335.98
CWB2000D	2000x650x880	040317807	£299.00	£358.80

CLARKE GRINDERS & STANDS

- Stands come complete with bolt mountings and feet anchor holes



FROM £64.99 exc.VAT
£77.99 inc.VAT

6" & 8" AVAILABLE WITH LIGHT

WAS £83.98 inc.VAT
WAS £107.98 inc.VAT

Model	Duty	Wheel Dia.	Order Code	exc.VAT	inc.VAT
CBG6RZ	PRO	150mm	060510211	£64.99	£77.99
CBG6250LW	HD	150mm	060716252	£69.98	£83.98
CBG6250LH	HD	150mm	060716251	£67.99	£81.59
CBG65B	PRO	150mm	060713050	£87.99	£105.59
CBG8370LW	HD	200mm	060718371	£94.99	£113.99

EASY WAYS TO BUY...

CALL & COLLECT AT STORES TODAY

CLICK & COLLECT OVER 10,500 LOCATIONS

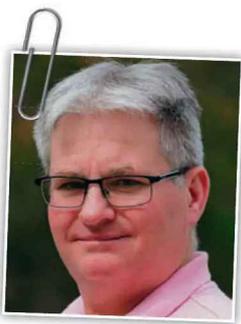
VISIT STORES NATIONWIDE

CALL 0115 956 5555

BROWSE machinemart.co.uk

BARNSELY, S71 1HA	01226 732297	DEAL KENT, CT14 6BQ	01304 373434	LIVERPOOL, L3 5NF	0151 709 4484	PRESTON, PR2 6BU	01772 703263
BIRMINGHAM, G7, BARR, B43 6NR	0121 358 7977	DERBY, DE1 2ED	01332 290931	LONDON CATFORD, SE6 3ND	0208 695 5684	SHEFFIELD, S2 4HU	0114 258 0831
BIRMINGHAM HAY MILLS, B25 8DA	0121 771 3433	DONCASTER, DN2 4NY	01302 245999	LONDON EDWINTON, N18 0Z0	0208 803 0861	SIDCUP, DA15 9LU	0208 3042069
BOLTON, BL3 6BD	01204 366799	DUNDEE, DD1 3ET	01382 225140	LONDON LEYTON, E10 7EB	0208 558 8284	SOUTHAMPTON, SO17 3SP	02380 557788
BRADFORD, BD1 3BN	01274 390942	EDINBURGH, EH8 7BR	0131 659 5919	LUTON, LU4 8JS	01582 728063	SOUTHEND, SS1 3JJ	01702 483742
BRISTOL, BS5 9JJ	0117 935 1060	EXETER, EX2 8QG	01392 256744	MAIDSTONE, ME15 6HE	01622 769572	STOKE-ON-TRENT, ST1 5EH	01782 287321
BURTON, DE14 3GZ	01283 564708	GATESHEAD, NE8 4XA	0191 493 2520	MANCHESTER, OPENSHAW, M11 1AA	0161 223 8376	SUNDERLAND, SR2 9QF	0191 510 8773
CAMBRIDGE, CB4 3HL	01223 322675	GLASGOW, G4 9EJ	0141 332 9231	MANSFIELD, NG19 7AR	01623 622140	SWANSEA, SA7 9AG	01792 792969
CARDIFF, CF24 3DN	02920 465242	GLOUCESTER, GL1 4HY	01452 417948	MIDDLESBROUGH, TS17 6BZ	01642 677881	SWINDON, SN1 3SA	01793 491717
CARLISLE, CA1 2LG	01228 591666	GRIMSBY, DN32 9BD	01472 354435	NORWICH, NR2 4BL	01603 766402	TWICKENHAM, TW1 4AW	0208 892 9117
CHELtenham, GL52 2EH	01242 514402	HULL, HU9 1EG	01482 223161	NORTHAMPTON, NN5 5JN	01604 267840	WARRINGTON, WA2 8JP	01925 630937
CHESTER, CH1 3SE	01244 311258	ILFORD, IG2 7HU	0208 518 4286	NOTTINGHAM, NG1 1GW	0115 956 1811	WIGAN, WN5 9AU	01942 323785
COLCHESTER, CO1 1RE	01206 762831	IPSWICH, IP1 1UZ	01473 221253	PETERBOROUGH, PE1 2PE	01733 311770	WOLVERHAMPTON, WV4 6EL	01902 494186
COVENTRY, CV1 1HT	02476 224227	LEEDS, LS4 2AS	01173 231 0400	PLYMOUTH, PL4 9HY	01752 254050	WORCESTER, WR1 1JZ	01905 723451
CROYDON, CR2 6EU	0208 763 0640	LEICESTER, LE4 6PN	0116 261 0688	PORTSMOUTH, PO3 5EF	01202 717913		
DARLINGTON, DL1 1RB	01325 380841	LINCOLN, LN5 8HG	01522 543036		02392 654777		

Calls to the catalogue request number cost 7p per minute plus your telephone company's network access charge. Calls may be monitored. All prices correct at time of going to press. We reserve the right to change products and prices. All products subject to availability, E&OE.



For this, the definitively final *Butterside Down*, we find Steve Goodbody in England, in rural East Sussex, exactly one week after his visit to New Jersey, ready to celebrate a significant milestone in another club's history.

The View from



Part 29 Two Days In June



Photo 161: In 1989, Geoff Billington and his lovely Class 12A *Lorna* descending the grade towards Bentley station.

In the prior instalment, I visited the New Jersey Live Steamers in America, at the inauguration of its restored late-Victorian mill engine, and discovered that its member's interests, though diverse, do not prevent them from celebrating each other's achievements with pleasure.

THE UNCOMMON THREAD

"This", the enraptured visitor announced at the conclusion of the congratulatory speeches on Saturday evening, "is my favourite club in the country. And you lot...", he continued, gesturing to those around him, "are the happiest and friendliest bunch I've ever met!" In all honesty, if I were to stop writing now, you'd know all you need to know about the Bentley Miniature Railway: it's an incredibly happy and friendly place.



Photo 162: Nearly forty years later, in the same location, Keavy pilots the Class 12A, while soon-to-be husband Stephen is at the controls of the *Dean Goods* behind.



Photo 163: Paul keeps an eye out for trespassers, for Bentley, like New Jersey, is plagued by risk-taking gnomes.

On the face of it, though, it's tough to put a finger on exactly why this should be; after all, there are lots of model engineering clubs, and miniature railways abound in general, so why should Bentley be so special? Having known the railway and its formative characters well from the very beginning, I believe the root cause is surprisingly simple; those earliest founders, forty-plus years ago, were (and those still with us remain) unwaveringly generous, friendly and pleasant people. Thus, with the club's foundations set both literally and figuratively, I believe that, under the influence of the original members, the club grew, chain-reaction style, and Bentley flourished to become an entire organisation of generous, friendly and pleasant people, exactly as exists today.

Now this may all seem a bit pseudo-psychological, but please hear me out for I have an example in mind, one which neatly connects the dots from the railway's earliest days to the present, and which requires just two pictures to explain.

In **photo 161**, taken a few years after the railway's opening, the late Geoff Billington, designer and builder of the magnificent locomotive on which he is seated (which was then called *Lorna* after his lovely wife, but has since reverted to be known by its type, *Class 12A*), one of the nicest people you could ever meet, descends towards Bentley Station. On arrival, I recall, he joked with the next load of passengers, infectious laughter always followed Geoff, and then, claiming a stiff back, relinquished his engine to one of the railway's younger members, yours truly, for he loved to encourage the next generation of model engineers.

In **photo 162**, Geoff's locomotive is again shown, the lead engine of the two, now restored, repainted and beautifully lined to better-than-new condition by its current owners Stephen (who is at the regulator of the *Dean Goods* behind) and Keavy (who is driving the engine itself). Although this photograph is taken in the identical location as the first, and the engine is essentially the same, nearly forty years have passed between shutter-clicks. As they entered the station, Keavy and Stephen joked with those in attendance, infectious laughter always follows them, and then, claiming stiff legs, Keavy relinquished her engine to one of the railway's antiquated members, yours truly again, for she is just that type of person. Neither Keavy nor Stephen, soon to be husband and wife, were born until long after the first picture was taken.

"So what?" I hear you say. I'm glad you asked.

The thing is, Stephen and Keavy were Geoff's protégés, and while I did not have the pleasure of meeting them until very recently, this was, to me, abundantly obvious. Their generosity, their enthusiasm, their above-and-beyond commitment and their infectious laughter, are *exactly* as I remember of their mentor and his super wife, decades ago, although I'm not sure they fully realize it themselves. Hopefully, when they read this, it will give them an inkling.

A WORLD AWAY?

As you may recall from the prior episode, the wide-ranging pursuits, quirkiness and camaraderie of its members are things I particularly enjoy about the New Jersey club, and, as I wandered around Bentley the following



Photo 164: The not-quite-finished *Uckfield Flyer* recreation, built singlehandedly by John over the winter.

weekend, a similarly diverse range of interests, amity and whimsy were evident, **photo 163**.

For example, while much of Bentley's motive power is steam-driven, the interest in other forms of propulsion is notable, battery-driven in the main. To illustrate this, John's not-quite-finished-but-entirely-new *Uckfield Flyer*, a recreation of the club's original three-coach passenger hauler and on display for the first time, was a personal highlight; for the original *Flyer*, running on a portable track, earned much of the cash for the railway's original construction (*ME 4711*). While John's new version is battery-electric rather than Suffolk-Punch at heart, the resemblance to the original is uncanny, **photo 164**.

Similarly, Paul's excellent *Class 73*, completed shortly after the railway's opening in 1985 and lapping the track on a regular basis during this weekend, still looks and performs as well as ever, **photo 165**, while Hugh's radio-controlled *Class 31* zipped happily along with (and, disconcertingly, sometimes



Photo 165: Bridge-builder Paul and his *Class 73* electro-diesel: forty-years on and both going strong.



Photo 166: Hugh, with a goods train behind his radio-controlled Class 31.



Photo 167: Thirteen-year-old James and the steam-outlined battery locomotive. The vuvuzela has been tucked out of sight, briefly.



Photo 168: Just some of Bentley's many goods wagons, private-owner and otherwise, ready to be marshalled at the start of the weekend.



Photo 169: Harry, at the controls of Mike's BR Standard Class 5 *King Leodegrance*, approaches Woodland station with a GWR goods

without) its driver behind, **photo 166**. However, of all the battery-powered trains, the most entertaining for me, was a steam-outlined tank locomotive in the capable hands of thirteen-year-old James, which lapped the track near-continuously on Sunday afternoon, its presence forewarned by the goose-like honk of her driver's vuvuzela (look it up) at all the appropriate places on the circuit, **photo 167**.

In addition to the marked interest in non-steam traction, another notable similarity to the prior weekend's American event was the multitude of scale wagons in evidence, of every type imaginable, all of them works of art; mustered into numerous trains of varying length and surprising weight, **photo 168**.

However, it is the steam locomotives that garner much of the visitor's attention, and, at Bentley, the number and variety of the club's current roster is impressive. To give just a few further examples, Mike's magnificent BR

Standard Class 5, *King Leodegrance*, ran almost continuously, **photo 169**, as did Pete's Great Western Saint, *Robin Hood*, recently driven by ME ex-editor Martin Evans (Martin informs me) but none the worse for the experience, it appears, **photo 170**. In the larger scales, the club's Hunslet, once named *Desmond* after its original barn-donating owner (*ME 4713*), had been repainted, relined, renamed and renumbered by Stephen to mark the occasion, and on Saturday she was unveiled to considerable applause, **photo 171**.

Finally, on the Sunday, Stephen and Mike revealed another surprise, this time for Stephen's dad, having secretly fitted smoke deflectors to his SR Schools Class V, *Eton*, **photo 172**. Alan was so pleased, that, while Stephen took charge of *Eton*, he decided the time had come to steam his latest engine, an ex-SE&CR H-Class tank – one of my personal favourites – until then a glass-case model. Built by Jim

Ewins, an experimental model engineer whom many will remember for his clever innovations and flawless workmanship, I watched, amazed, as Alan demonstrated the faultlessly performing steam reverser and Weir pump, both fiendishly difficult achievements in our scales, **photo 173**.

TALES OF THE UNEXPECTED

One of the best things about events such as these, in my opinion, is that, while you know roughly what to expect most of the time, something surprising always crops up. For me, two such happenings occurred during the weekend, the first while I was preparing to depart Bentley's central station at the regulator of the *Class 12A*, which I had been happily in charge of for much of the afternoon, thanks again to Keavy's kindness. As I shut off the injector, a strangely familiar voice wafted from the



Photo 170: GWR Saint Robin Hood, in action for most of the weekend, slows for a curve with another mixed goods.



Photo 171: At her unveiling, Stephen stands proudly with 1985 Bentley, in readiness for the fortieth anniversary celebrations.



Photo 172: SR Schools Eton, with her newly added smoke deflectors, waits to back onto her train at Bentley Central station.

rear of the train; one I recognized but couldn't place. Pondering this while waiting for the signal to turn green, it finally hit me, and, jumping hurriedly off, I introduced myself to the surprised passenger, Chris Vine, author of the peerless *How (not) to Paint a Locomotive*, the very book which had guided me through the trials and tribulations of painting my own engine, *Jennifer Ann*, over the course of a decade (ME 4721 and 4724). Chris, if you are reading this, I hope the *Class 12A* and I gave a decent account of ourselves under your distinguished scrutiny!

The final surprise, proving that it really is a small world, came an hour or so later, when Tom, a visitor from Echills Wood, approached. "Is it true that you're a member of the New Jersey Live Steamers?" he enquired, after introducing himself. "That's right," I answered, aware that word had gotten around after several similar encounters during the weekend, "have you visited us?"

Tom shook his head. "Not personally, but I recently sold my favourite engine to a chap there. Perhaps you know

him? His name's Matt, he's English, and the engine's a Midland compound, a *real* Midland compound". Tom, it transpired, had owned the very engine which had been striding around the New Jersey track just one week earlier!

DRAWING TO A CLOSE

So, there we have it – two continents, two organizations, and the final episode of *Butterside Down*.

While the Bentley Miniature Railway, now over a mile long, fully signalled - just like the NJLS - and a true Rolls-Royce of a railway, is an entirely impressive achievement, that's not the most significant thing about the place, as the enthusiastic visitor succinctly observed at the top of this episode. For Stephen, Keavy, John, Peter, Mike, Paul, Barry, Millie, Kieran, Charlie, Harry, Hugh, Alan M, Alan D, Tom, Adrian, Tim, James

and the many others whose names I have no-doubt accidentally (and regretfully) omitted, some of them part of the original team but mostly more recent members, have combined to form an exact reflection of the railway's earliest group - an entirely generous, friendly and pleasant bunch, utterly committed to what they are doing, and, above all, happy; just like the New Jersey Live Steamers an ocean away.

This, not coincidentally, is what I believe makes these two clubs such special and successful organizations, for no matter the differing backgrounds and interests of their individual members, they appreciate the fruits of each other's efforts, don't take themselves too seriously, and, crucially, enjoy doing what they do together. I congratulate them both on these achievements, for, in the author's view, they make all the difference in the world. 🍷

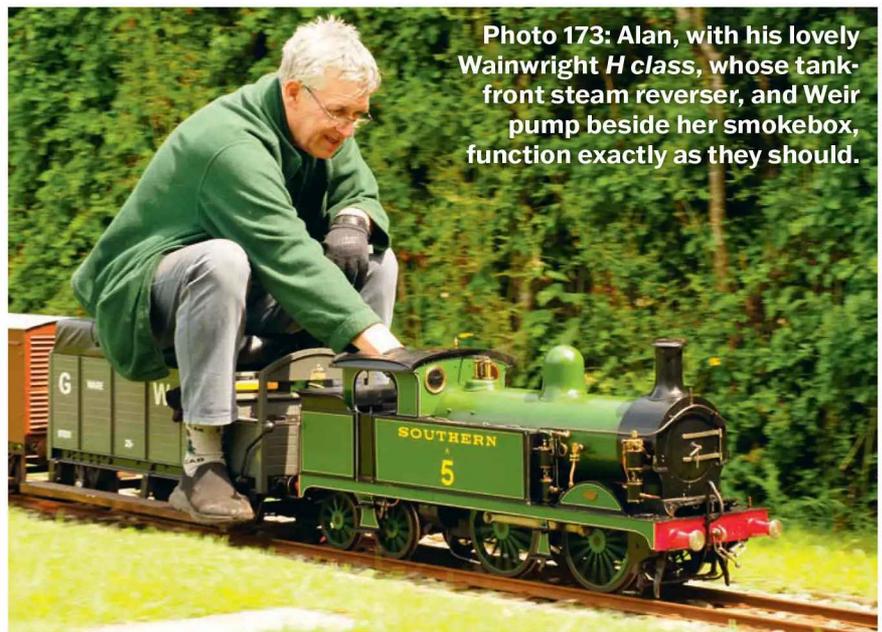


Photo 173: Alan, with his lovely Wainwright H class, whose tank-front steam reverser, and Weir pump beside her smokebox, function exactly as they should.

If your hobby includes any aspects of engineering, the **ME&W** will have much to interest you in its pages. Bigger than either of its predecessors it has the space to cover all aspects of model engineering from traditional live steam models to gas turbines, from clocks to toolmaking. We look in depth at the skills you need to get the most out of your hobby: using maintaining and improving lathes, mills and other workshop machines such as 3D printers and CNC. We also cover the widest range of workshop activities – traditional ones like casting, brazing and welding to modern skills like using embedded electronics. Finally, we keep you up to date with what's happening in the world of hobby engineering with our event reports, news features and reviews.

Neil Wyatt

Neil Wyatt

REASONS TO SUBSCRIBE

- 1 Models illustrated with plans and photos
- 2 Tools and equipment for your workshop
- 3 Reports on hobby engineering events
- 4 Hints, tips ideas and advice

SUBSCRIBE TODAY

MODEL ENGINEER & WORKSHOP
EST. 1898
THE LEADING MAGAZINE FOR HOBBY ENGINEERS
www.model-engineer.co.uk

MMEX 2025
ANOTHER GREAT MIDLANDS EXHIBITION

Easier Screwcutting on your lathe
CHANGEWHEEL GEARING IMPROVED

INSIDE this packed issue:
MODERN TECHNOLOGY IN THE WORKSHOP · FORMING CURVES IN BRASS ANGLE · LITTLELEC 2025 RESULTS AND REPORT · FLUTING TAPERED COLUMNS · A TAILSTOCK TAPER EXTRACTOR · MAKING SADDLE TANKS IN LASER CUT BRASS · CLEAR RESIN 3D PRINTS · VALVES FOR A STATIONARY MILL ENGINE · REPAIRING LIQUID PUMPS · FINISHING THE BR MOGUL'S BOILER · A COVENTRY DIE CHASER SHARPENING JIG · PLUS ALL YOUR REGULAR FAVOURITES!

GET MORE OUT OF YOUR WORKSHOP WITH ME&W

Make a Honing
WITH LINKS TO DOWNLOADABLE FILES ON OUR

An
LBA
Ter
BRUCE BOLD
HIS EXPERIE
CONSTRUCTI
MARTIN EVA

CHANGEWHEEL GEARING IMPROVED
GIBS AND SPLIT BEAR
FINISHING TOUCH
REPRODUCING VAN
MODERN TE

GET MORE O

Terms & Conditions: UK Direct Debit, you will pay £57.99 for 12 issues, then £57.99 annually thereafter. Savings based on the standard price per issue for 12 issues. Offer ends December 31, 2026. Your subscription will start with the next available issue and you will receive 12 issues in a year. For full terms and conditions visit shop.kelsey.co.uk/terms-and-conditions. We take great care in handling your personal details and these will only ever be used as set out in our privacy policy which can be viewed at shop.kelsey.co.uk/privacy-policy. You may unsubscribe at any time.

GET ONE YEAR OF MODEL ENGINEER & WORKSHOP FOR JUST £57.99



THE TOOLS AND
TECHNIQUES USED
BY MODEL MAKERS,
LIGHT ENGINEERS
AND RESTORERS.

SAVE

ON YOUR **MODEL
ENGINEER &
WORKSHOP**
SUBSCRIPTION



←
*Scan
me*

EASY WAYS TO SUBSCRIBE

1. GO TO **CLASSICMAGAZINES.CO.UK/MEW2026**
2. CALL US **01507 529529** QUOTE **MEW2026**
3. USE THIS **QR CODE** TO GO DIRECTLY TO OUR WEBSITE

Lines open Monday-Friday, 8:30am-5:30pm. Calls charged at your standard network rate.

Readers' Tips

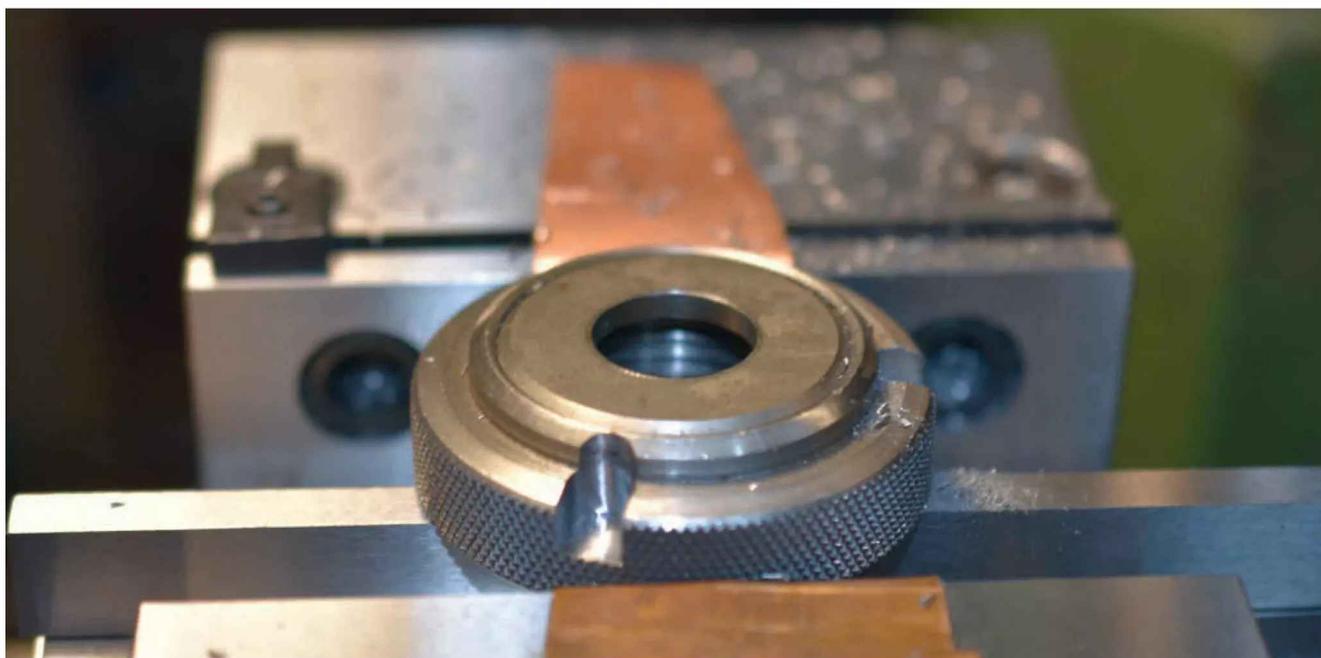


We have £30 in gift vouchers courtesy of engineering suppliers Chester Machine Tools for each month's 'Top Tip'. Email your workshop tips to meweditor@mortons.co.uk marking them 'Readers Tips', and you could be a winner. Try to keep your tip to no more than 400 words and a picture or drawing. Don't forget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

TIGHTENING AND RELEASING THE MYFORD COLLET NOSE

Our tip winner this month is John Bauer who offers advice for ageing hands:

As hands age, tightening the Myford collets becomes increasingly fraught. By modifying the nose piece as shown a suitable C-spanner can be applied, in this case one of 53-55 mm size. A 1/4 inch 4-flute milling cutter fed carefully did the necessary without cutting oil.

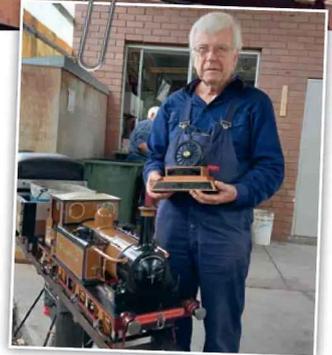


Please note that the first prize of Chester Vouchers is **only available to UK readers**. You can make multiple entries, but we reserve the right not to award repeat prizes to the same person in order to encourage new entrants. All prizes are at the discretion of the Editor.



An LB&SCR Terrier in 5" Gauge PART 3

Bruce Boldner concludes the description of his approach to the construction of a London, Brighton and South Coast Railway A1 Class Locomotive.



Moving on from the smokebox, let's look at the firebox end of the boiler. **Photographs 47 and 48** show the ashpan (with rear opening and a bottom drop door) again using laser cut parts by MEL.

The full-size *Terriers* have an unusual fire door. It is hinged inside the firebox at the top and swings inside the firebox when opened. It is operated by a lever over a notched plate similar to a reversing lever.

I decided against replicating this arrangement, as the fire door does not appear to move a full ninety degrees into a position parallel to the rails, but rather droops down somewhat inside the firebox when opened. I felt this would partially impede my shovel when adding coal. I instead hinged my fire door externally at the bottom of the



Photo 47: The ashpan.



Photo 48: Underside of ashpan.



Photo 49: Bottom hinged fire door.



Photo 50: The oil reservoir to pipe oil to the front axle boxes.



Photo 51: Oil tank mounted inside right water tank to deliver oil to eccentrics and piston rods via silicon tubing.



Photo 52: The displacement lubricator.



Photo 53: Adhesive backed masking templates.



Photo 54: Applying the dark olive trim.

fire hole, **photo 49**. On the full-size Terriers, the bottom of the fire hole is level with the cab floor. I therefore did the same on the model. This does of course reduce the depth of the fire. Initial runs have indicated that I may have to coal up more often than envisaged because of this. No matter, I must simply adapt to whatever firing is required.

Access for oiling the connecting rods, eccentrics & axle boxes is very limited, due mainly to the side water tanks. On my Stirling single, I linked external oil reservoirs to nipples on the eccentric straps and connecting rods via fine silicone tubing. I decided to do the same on the Terrier. The latter locomotive has ended up with far more tubes. Whether they will function well, or tie themselves in knots, only time will tell.

A three-pipe reservoir mounted on the front of each water tank pipes oil to the front axle boxes, **photo 50**.

I have installed a large flat oil tank on the inside of the right-hand water tank. Eight pipes deliver oil: two to the right-side driving axle box, four to the eccentrics and one each to the two piston connecting rods, **photo 51**. I decided it was too much of a stretch to pipe oil to the left side driving axle box from this reservoir. The left-hand driving axle box therefore receives oil piped down directly from a small reservoir inside the left water tank.

For lubricating the cylinders, the plans proposed a mechanical lubricator mounted in the cab and driven by a crank off the right rear wheel. As part of the cab interior had to be cut away to accommodate this lubricator, I decided

to instead install a displacement lubricator tank behind the buffer beam, from which oil is dispersed directly into the front of the steam chest at the entry point proposed for the mechanical lubricator. Although via an open orifice, instead of via a one-way clack, **photo 52**.

PAINTING

I at first painted the Terrier in a yellow ochre, as this seemed to approximate the colour I'd seen in photos of various models. I was to subsequently change this colour, more on this later. (These photos featuring the yellow ochre are the only photos that I have to illustrate this stage of the painting process.)

There are now no commercially available decals for a Terrier, which is



Photo 55: Templates removed to reveal base colour.

surprising for what I understand to be a popular model in the model engineering world. My friend Mike Boddy therefore made some drawings which I used to order adhesive backed templates, these were applied over the base colour, **photo 53**. The whole body was then sprayed with dark olive, **photo 54**. The templates were removed to reveal the yellow ochre base colour, **photo 55**.

Although I'd hand lined my previous locomotives with brush and masking tape, I decided I'd never be able to hand line the Terrier accurately and precisely, with its red/black/white lining and inverted corners. Mike Boddy therefore draughted some drawings and I sent these to a decal manufacturer in India named

Hobbyistdecals. They produced decals precisely to size and with excellent colour rendition.

However, I found it extremely difficult to apply the larger of these water slide transfers without distortion. So I then ordered them as adhesive backed fine vinyl decals from the same manufacturer. These were much easier to apply, although there was some occasional distortion which was hard to eliminate without leaving the odd fine wrinkle. However, on balance, I am satisfied with the result.

The unusually shaped cab roof was 3D printed in plastic, **photo 56**. It's a convenient way to replicate an unusual shape. However, I have since discovered that this plastic is prone to warp

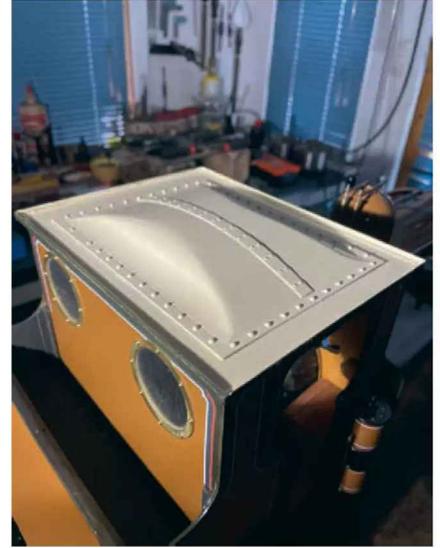


Photo 56: The 3D printed cab roof.

under even moderate heat, such as an afternoon in the sun. I have accordingly glued the contoured, printed part of the roof to a stiff brass plate with JB Weld. In any case, the roof and rear cab wall will always be removed when running. We shall see what happens.

Photographs 57, 58 and 59 show my Terrier finally complete, painted and lined, at which time I should explain the change in base colour.

When I first received the Terrier lining booklet from Phoenix Paints, I could not believe the dark brown chip was truly Stroudleys Improved Engine Green ('IEG'), but I then purchased an LBSCR book from the Brighton Circle in the UK. This book contained a colour chip chart and the Improved Engine



Photo 57: Rear view of the Terrier finally complete, painted and lined.



Photo 58: Side view.



Photo 59: Front view.

Green chip in this looked to be identical to that of Phoenix Paints.

More pertinently, a leaflet was included with the Brighton Circle book, which stated that there is only one surviving example of this paint that was applied in Brighton Works in Stroudley's day. This exists on the model of the locomotive Como held in Brighton

Museum. Using a range of swatches, each considered to be an acceptable representation of IEG, one swatch was identified as being indistinguishable from Como's Paint. This swatch was accurately matched by Craftmaster Paints and the swatch included here was carefully matched to that. I had my paint colour matched to this chip here

in Australia. I don't know about you, but that's good enough for me. I have since purchased some excellent number and works plates from Diane Carney to complete the model.

When I first drove my Terrier, I was surprised at how readily the fire died with resulting loss of steam pressure. I had the blower fully open throughout but couldn't manage even half a circuit of our club track before I ground to a halt. I assumed this was due to my inability to properly fire a small boiler. However, this is the third 5" gauge locomotive that I have built and I have never had a problem firing my Johnson and Stirling single drivers, which don't have particularly large boilers.

Back in 1967, 1968 and 1970 Australian Sir Ronald East wrote articles on construction of his Martin Evans 5" gauge Terrier, published in *Model Engineer*. He mentioned difficulties in timing the engine, due to the inaccessibility of the steam chest ports. However, he did not mention any difficulties in firing.

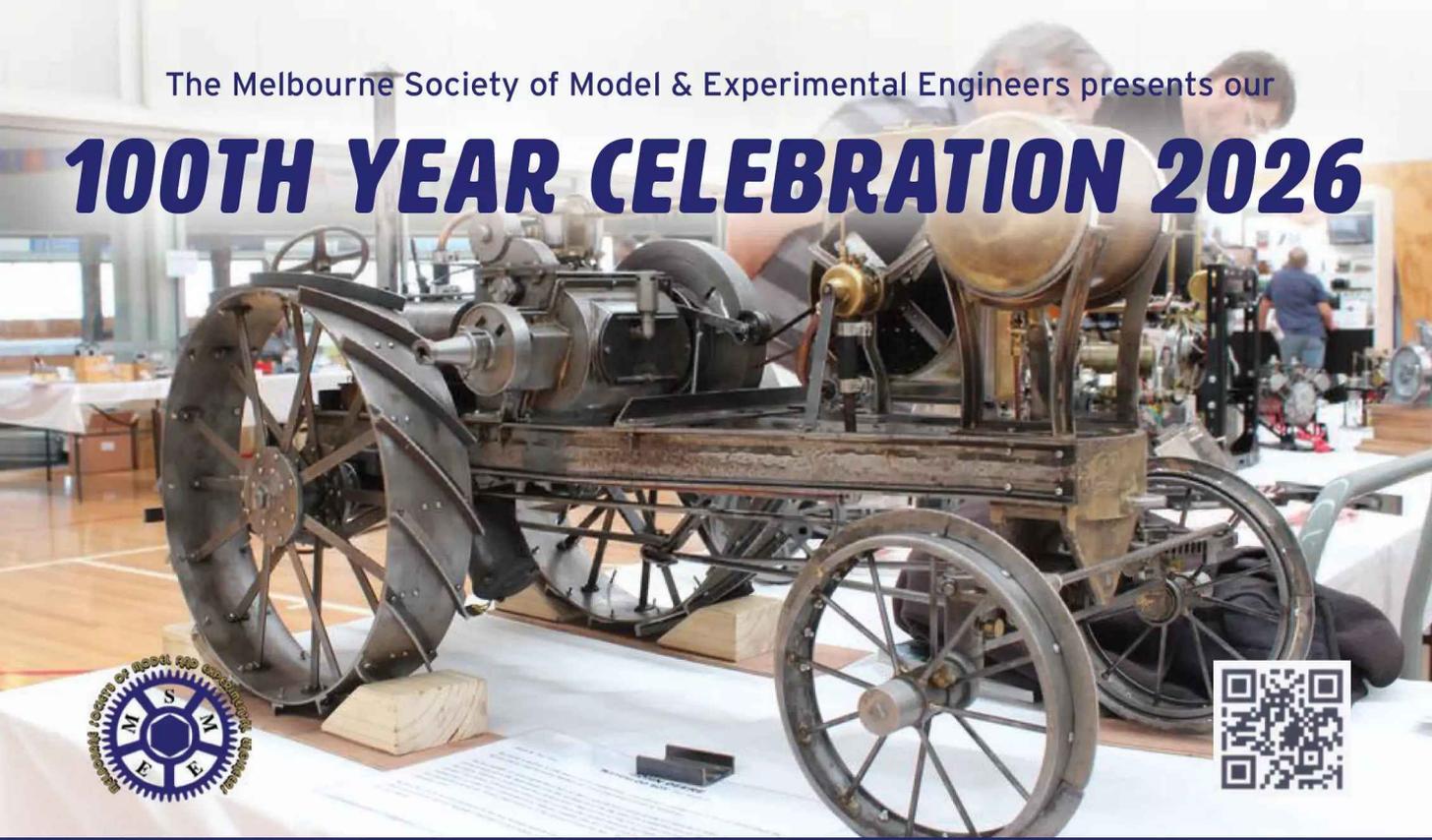
His Terrier still exists and is now in the hands of at least its third owner, who told me that the locomotive steams beautifully. Indeed I've seen it run at our club on a number of occasions. At my request, he kindly allowed me to visit and measure his Terrier. I was astounded to find that the top of the blast nozzle was just 12mm below the bottom rim of the petticoat in the smokebox of the Sir Ron East Terrier. I would be very interested to know whether other Terrier builders have found it necessary to make this modification. I have never seen it mentioned in all the Terrier articles I've read.

The gap between blast nozzle and petticoat on my model was 7/8" (22.22mm) because this is what my Martin Evans plans specified. After building a taller blast nozzle to also achieve the 12mm gap, my Terrier now steams readily and maintains pressure around our track with the blower just cracked open. You can see a video of the engine here: tinyurl.com/mva5ubv3.



The Melbourne Society of Model & Experimental Engineers presents our

100TH YEAR CELEBRATION 2026



SATURDAY 3RD - SUNDAY 4TH OCTOBER 2026

SOUTH OAKLEIGH COLLEGE, BAKERS RD, SOUTH OAKLEIGH, VICTORIA, AUSTRALIA

This year we invite you all in celebrating Melbourne Society of Model & Experimental Engineers Centenary 100th Anniversary! To mark such a historic event, our exhibition will be hosted over two full days, back to back. We hope to see you there.

Use our website to get in touch if you'd like to exhibit models from past club or family members. As for our centenary, we hope to feature earlier work alongside today's latest creations.

To keep up to date with further information, visit our website or Model Engineer & Workshop's website.



At this time, we would also like to recognise and celebrate 51 years for the Australian Antiquarian Horological Society and 42 years for the Melbourne Meccano Club Inc.



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

PostBag is one of the most popular sections of the magazine - readers 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 neil.wyatt@kelsey.co.uk.

THE FALKIRK WHEEL

Dear Neil, I found the piece on the Falkirk wheel very interesting, it is an example of good innovative British engineering well executed. For those readers interested in barge lifts there are a number within easy reach of Calais.

The first is an original lift (Ascenseur de Fontenettes) in Arques (St Omer) about 25 miles outside Calais, based on the Anderton lift in the UK. One feature of this lift is that the associated machine shop is water powered.

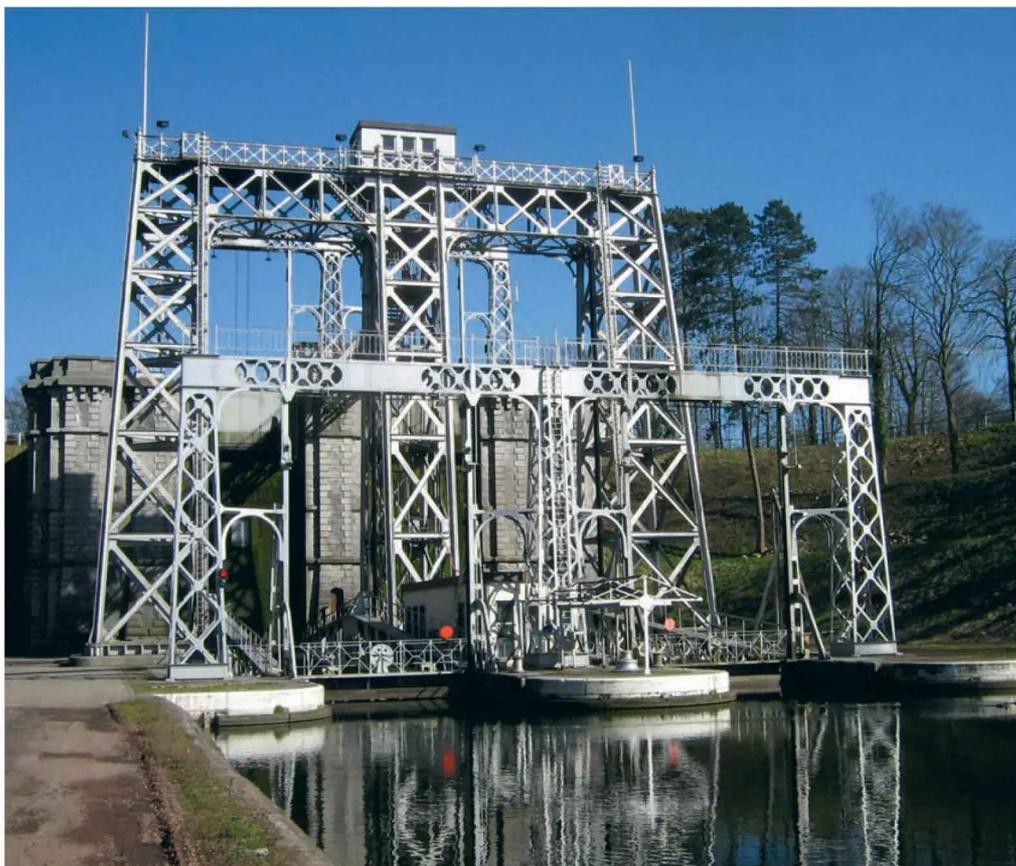
The most impressive, finished in 2002, is the lift at Strepv-Thieu on the Belgian border that has a height of around 70 metres and I think has a capacity of several thousand tons in the two tanks which counterbalance each other. Nearby is an inclined plane lift at Ronqueres where the barge is held in essentially a tank and run on railway lines up a slope. Both of these installations were designed to replace existing locks and lifts of the Canal du Centre that is now apparently a UNESCO World heritage site. Further afield, perhaps the most inventive and interesting is the Pente d'eau de Montech north of Toulouse apparently built in 1974. The principle is an inclined channel with a closely fitted plate supported by two large

tractors one on each side of the channel. The barge enters and the plate is lowered behind it and the two tractors drive up the incline pushing the water and the barge up the slope. I think that barge tours of the canal feature a ride on a barge taken up this slide, very interesting and unique and a very typical innovative French approach to engineering! What all of these examples show is

that our Continental neighbours have a much more practical and pragmatic vision of the practical uses of canal transport as part of the transport network.

Mike Matthews, Sandwich, Kent.

I found this photograph of Boat lift no. 3 on the old section of the Canal du Centre, Strépy-Bracquegnies, Belgium; it certainly is impressive - Neil



JOHN WILDING CLOCK #1

Neil, with reference to Mike Moore's request for information on large balance wheel clock by John Wilding. This was John's version of the *Murday Clock* published in *The Clock Maker* a Tee Publications magazine. He needs Volume 1, issue 8 June/July 1991 to Volume 2 Issue 3 August/September 1992, over eight issues. If he wants to make a replica of the Murday clock he needs Volume 2 issue 2 June/July 1992 to Volume 2 Issue 8 June/July 1993, seven issues, these were by Alice Price FBHI.

Michael Gaze, by email.

JOHN WILDING CLOCK #2

Hello Neil, I see that in Postbag of the MEW February issue that Mike Moore has asked for help in finding out about the Large Balance Wheel clock as detailed in our book by John Wilding, detailed in our catalogue available from sales@ritetimepublishing.com. Please pass our details on to him.

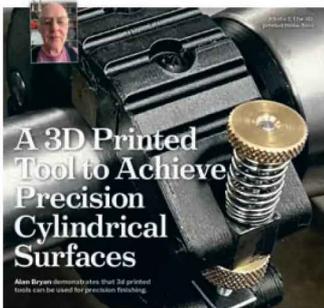
Roger Drake, RiteTime Publishing Ltd

DELAPENA HONES

Good morning, Neil, The kits for the Delapena clone hones are still listed by Polly Model Engineering. www.polly-me.co.uk.

Bruce Cassing, by email

Thanks Bruce, this will be useful for readers without access to a 3D printer – Neil.



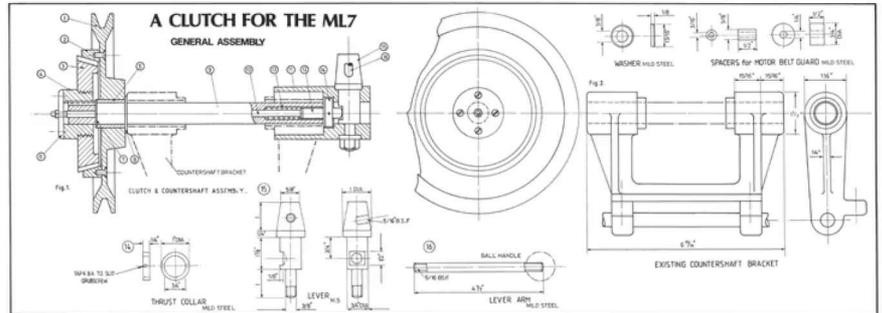
A 3D Printed Precision Cylindrical Surfaces
Alex Baynes demonstrates that 3D printed tools can be used for precision finishing.

A CLUTCH FOR THE MYFORD ML7

Back in 1991 I built the clutch shown in your issue number 5 of *Model Engineers' Workshop*. The clutch has work brilliantly for all these years. In a mad fit of tidying, my wife threw out that magazine and even though I took out a digital subscription with you some years later, I have not got the original full sized pullout drawing.

Can I buy a digital copy of that technical drawing?
Stephen Owen, by email

Hi Stephen, unfortunately the free pullouts weren't feasible to include in the digital archive. Thanks to the efforts of Nick Farr, they were all scanned and you will have received an electronic copy of the drawing with my compliments by now. This is not the first report of the design being very effective, and as there are still many ML7 owners who could benefit, we will be republishing this excellent design soon - Neil



Model Engineers' Workshop Article Index

DATA to June 2012
Copyright © Colin Usher, 2012 Chicago Latrobe Bookers
Doris Pithorn Colin Usher

The spreadsheet-based index compiled and hosted by Colin Usher at www.colinusher.info has been an invaluable resource for hobby and model engineers for many years. Unfortunately, as of July 2012, Colin has no longer been able to update the index.

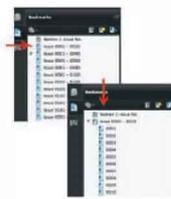
I am pleased to say that, with Colin's agreement I have taken on the task of keeping the index up to date. I will supply Colin with the updated files to maintain the continuity of his site, but this page will be the 'official' home of the index for the foreseeable future.

DATA and Amendments from July 2012
Copyright © Neil M. Wyatt, 2014

Notwithstanding my personal involvement with Model Engineers' Workshop magazine, this is a voluntary activity and the index is not linked in any way with MyTimeMedia Ltd. The index is offered as a free service to hobby engineers for personal use only, and it is not intended for commercial use. No liability can be accepted for any errors or omissions or any consequential loss arising from use of the index. If you have any comments on the index, or find any errors or omissions in it, please use the contact email neil@stubbmandirel.co.uk to let me know.

How to navigate this index

This document is divided into two sections. The first is ordered by issue number and the second is ordered by the contributor name (where known). If you know the issue number, click on the small triangle nearest the first level bookmark. For example, if you want to go to the page for Issue 5, go to the bookmark 0001-0020 and click on the small triangle to the left to open it up. Then click on issue 5. If you want to see the article list ordered by author click on the lower section. This is organised in a similar way but alphabetically by name.



Alternatively, you can use the word / phrase search box.



ONLINE INDEXES

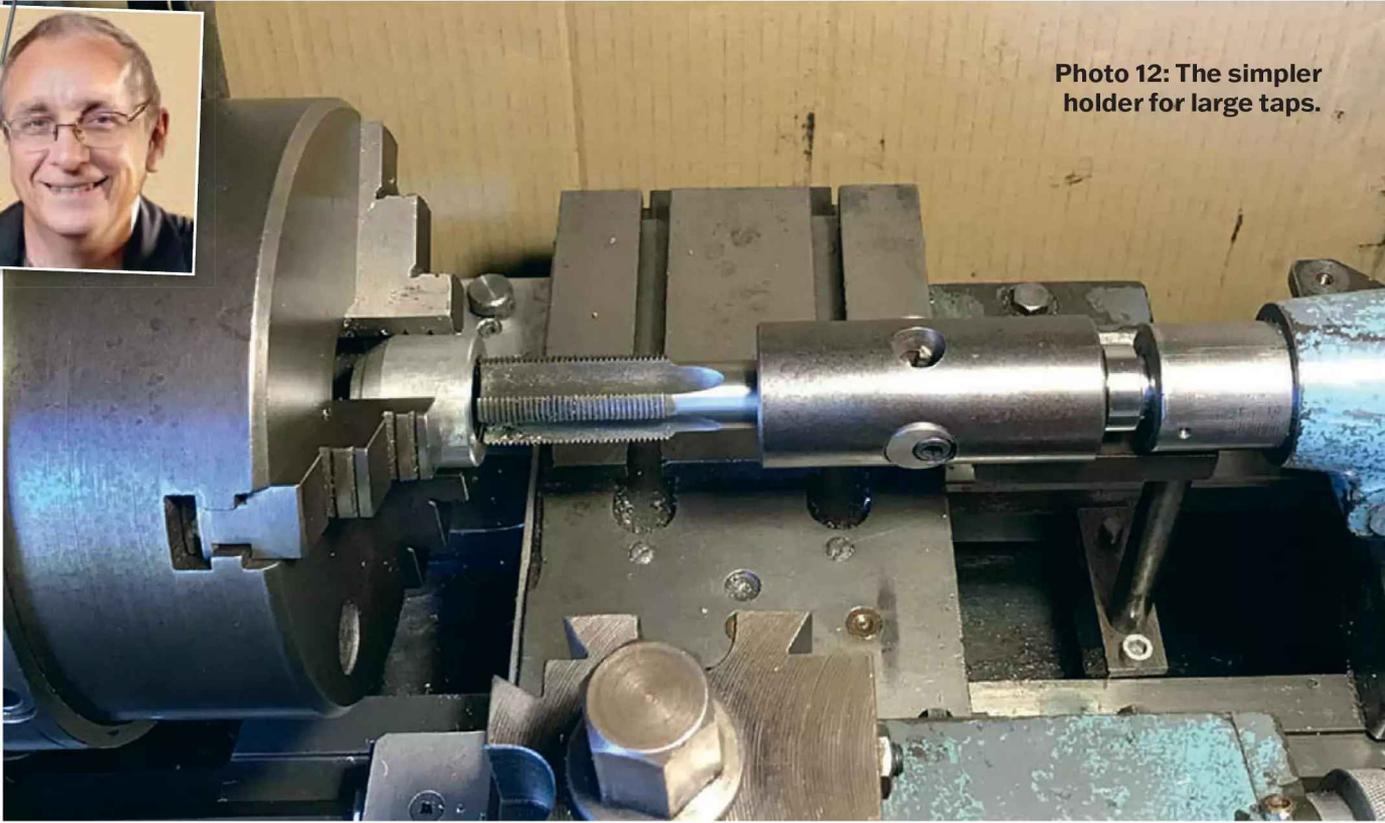
David Frith prepares the indexes for Model Engineer & Workshop. The latest copy can be downloaded on from the Forum at www.model-engineer.co.uk – just select Forums and then the Model Engineers' Workshop topic. Alternatively scan the adjacent QR code. If you prefer the paper indexes, don't worry, David continues to produce these as well.



Line	Year	Month	Issue	Page	Subject	Author	Key Word	Article Title
1	1990	Summer	1	10	Editorial	Wray, Stan	The new precision hobby magazines	Help, and welcome!
2	1990	Summer	1	12	Workshop	Balboon, Alan	A device for testing small, thin and delicate parts	A useful scale vice
3	1990	Summer	1	14	Measuring	Leader, Bob	Add ons to increase the versatility of the dial test indicator (DTI)	Adjustments for dial test indicators
4	1990	Summer	1	18	Measuring	Williams, B.	The square wheel in France	The square wheel in France
5	1990	Summer	1	19	Milling	Farrugia, S.	Simple Compad 2 milling head to allow accurate vertical travel measurement	Milling head modification for the Compad 2
6	1990	Summer	1	21	Quinn Tip	James, Peter	Stack the build from the polished metal gear	Stack for brass and copper
7	1990	Summer	1	22	Turning	Twist, Tim	Clubs and cross-side stops for Myford and other lathes	Stop trust
8	1990	Summer	1	24	Turning	Baerwald, C.S.	Large scale vernier measuring on steel saw	An inch with a pin out
9	1990	Summer	1	25	Quinn Tip	Wray, Stan	Internal hair from a plastic dustbin	Get tooth for good choice
10	1990	Summer	1	26	Quinn Tip	Stratford, M.	Simple adjustment to make fit to a pipe	A guide for the Arco-style sliding attachment
11	1990	Summer	1	28	Quinn Tip	Wray, Stan	Woodturning table on cast	The hobbyist's cart
12	1990	Summer	1	30	M/C Review	James, Peter	Workshop ideas, tools and fixtures	A new workshop
13	1990	Summer	1	32	Quinn Tip	Mau, Lee	Tools, clamps and other things	Get welding
14	1990	Summer	1	33	Quinn Tip	Wray, Stan	Repair your thinking lathe table	Measuring accuracy and references
15	1990	Summer	1	34	Quinn Tip	Wray, Stan	Handing your lathe and spines	Engineering of the Axure
16	1990	Summer	1	35	Quinn Tip	Wray, Stan	Three and four jaw chuck alternatives explained	A useful bracket cutter
17	1990	Summer	1	36	Quinn Tip	Wray, Stan	Control your lathe and camera closer	Choosing a chuck
18	1990	Summer	1	37	Quinn Tip	Wray, Stan	How to get the best out of the bench vice and some handy gadgets	Improving precision optics
19	1990	Summer	1	38	Quinn Tip	Wray, Stan	Converting a smaller attachment to a rotary table	Bench vice versatility
20	1990	Summer	1	39	Quinn Tip	Wray, Stan	General oil, lubricants and oil maintenance	Using and caring for your vice
21	1990	Summer	1	40	Quinn Tip	Wray, Stan	Common mistakes on construction from stock material	Common mistakes
22	1990	Summer	1	41	Quinn Tip	Wray, Stan	Setting up a lathe, generally edge feeder and tube feeder	Express setting up device
23	1990	Summer	1	42	Quinn Tip	Wray, Stan	The use of oil used in heat treatment and hardening	Quenching oil
24	1990	Summer	1	43	Quinn Tip	Wray, Stan	Double flat beam for your sheet metal	Sheet metal
25	1990	Summer	1	44	Quinn Tip	Wray, Stan	Clamping of body construction	Pittsburgh link
26	1990	Summer	1	45	Quinn Tip	Wray, Stan	Positive feedback	Steel rods in casting
27	1990	Summer	1	46	Quinn Tip	Wray, Stan	A tool for processing universal thread rods and forms	Readers Survey
28	1990	Summer	1	47	Quinn Tip	Wray, Stan	A device for testing the accuracy of the lathe table	Make a three wheel turntable
29	1990	Summer	1	48	Quinn Tip	Wray, Stan	Handing your lathe and spines	A variable head threading attachment
30	1990	Summer	1	49	Quinn Tip	Wray, Stan	Handing your lathe and spines	A simple scoring device
31	1990	Summer	1	50	Quinn Tip	Wray, Stan	Handing your lathe and spines	An aid to silver soldering
32	1990	Summer	1	51	Quinn Tip	Wray, Stan	Handing your lathe and spines	Simple material tools
33	1990	Summer	1	52	Quinn Tip	Wray, Stan	Handing your lathe and spines	Electricity in the workshop
34	1990	Summer	1	53	Quinn Tip	Wray, Stan	Handing your lathe and spines	Trade articles
35	1990	Summer	1	54	Quinn Tip	Wray, Stan	Handing your lathe and spines	Welcome to the workshop
36	1990	Summer	1	55	Quinn Tip	Wray, Stan	Handing your lathe and spines	A simple turning rest
37	1990	Summer	1	56	Quinn Tip	Wray, Stan	Handing your lathe and spines	Cheap paper boards
38	1990	Summer	1	57	Quinn Tip	Wray, Stan	Handing your lathe and spines	Lathe tooling
39	1990	Summer	1	58	Quinn Tip	Wray, Stan	Handing your lathe and spines	Time (over, beginner's time)
40	1990	Summer	1	59	Quinn Tip	Wray, Stan	Handing your lathe and spines	High temperature soldering
41	1990	Summer	1	60	Quinn Tip	Wray, Stan	Handing your lathe and spines	A visit to John Sealey Ltd
42	1990	Summer	1	61	Quinn Tip	Wray, Stan	Handing your lathe and spines	Signs and notices
43	1990	Summer	1	62	Quinn Tip	Wray, Stan	Handing your lathe and spines	Engineer's blue alternative
44	1990	Summer	1	63	Quinn Tip	Wray, Stan	Handing your lathe and spines	Hand tool set placement
45	1990	Summer	1	64	Quinn Tip	Wray, Stan	Handing your lathe and spines	Marking two pieces together
46	1990	Summer	1	65	Quinn Tip	Wray, Stan	Handing your lathe and spines	Eliminating backlash
47	1990	Summer	1	66	Quinn Tip	Wray, Stan	Handing your lathe and spines	Specialised screws
48	1990	Summer	1	67	Quinn Tip	Wray, Stan	Handing your lathe and spines	Make the Chapman's wood turning lathe
49	1990	Summer	1	68	Quinn Tip	Wray, Stan	Handing your lathe and spines	Getting a right (continued)
50	1990	Summer	1	69	Quinn Tip	Wray, Stan	Handing your lathe and spines	Marking up the ML7
51	1990	Summer	1	70	Quinn Tip	Wray, Stan	Handing your lathe and spines	A power racksize update
52	1990	Summer	1	71	Quinn Tip	Wray, Stan	Handing your lathe and spines	Computer
53	1990	Summer	1	72	Quinn Tip	Wray, Stan	Handing your lathe and spines	
54	1990	Summer	1	73	Quinn Tip	Wray, Stan	Handing your lathe and spines	
55	1990	Summer	1	74	Quinn Tip	Wray, Stan	Handing your lathe and spines	
56	1990	Summer	1	75	Quinn Tip	Wray, Stan	Handing your lathe and spines	
57	1990	Summer	1	76	Quinn Tip	Wray, Stan	Handing your lathe and spines	
58	1990	Summer	1	77	Quinn Tip	Wray, Stan	Handing your lathe and spines	
59	1990	Summer	1	78	Quinn Tip	Wray, Stan	Handing your lathe and spines	
60	1990	Summer	1	79	Quinn Tip	Wray, Stan	Handing your lathe and spines	
61	1990	Summer	1	80	Quinn Tip	Wray, Stan	Handing your lathe and spines	
62	1990	Summer	1	81	Quinn Tip	Wray, Stan	Handing your lathe and spines	
63	1990	Summer	1	82	Quinn Tip	Wray, Stan	Handing your lathe and spines	
64	1990	Summer	1	83	Quinn Tip	Wray, Stan	Handing your lathe and spines	
65	1990	Summer	1	84	Quinn Tip	Wray, Stan	Handing your lathe and spines	
66	1990	Summer	1	85	Quinn Tip	Wray, Stan	Handing your lathe and spines	
67	1990	Summer	1	86	Quinn Tip	Wray, Stan	Handing your lathe and spines	
68	1990	Summer	1	87	Quinn Tip	Wray, Stan	Handing your lathe and spines	
69	1990	Summer	1	88	Quinn Tip	Wray, Stan	Handing your lathe and spines	
70	1990	Summer	1	89	Quinn Tip	Wray, Stan	Handing your lathe and spines	
71	1990	Summer	1	90	Quinn Tip	Wray, Stan	Handing your lathe and spines	
72	1990	Summer	1	91	Quinn Tip	Wray, Stan	Handing your lathe and spines	
73	1990	Summer	1	92	Quinn Tip	Wray, Stan	Handing your lathe and spines	
74	1990	Summer	1	93	Quinn Tip	Wray, Stan	Handing your lathe and spines	
75	1990	Summer	1	94	Quinn Tip	Wray, Stan	Handing your lathe and spines	
76	1990	Summer	1	95	Quinn Tip	Wray, Stan	Handing your lathe and spines	
77	1990	Summer	1	96	Quinn Tip	Wray, Stan	Handing your lathe and spines	
78	1990	Summer	1	97	Quinn Tip	Wray, Stan	Handing your lathe and spines	
79	1990	Summer	1	98	Quinn Tip	Wray, Stan	Handing your lathe and spines	
80	1990	Summer	1	99	Quinn Tip	Wray, Stan	Handing your lathe and spines	
81	1990	Summer	1	100	Quinn Tip	Wray, Stan	Handing your lathe and spines	



Photo 12: The simpler holder for large taps.



Holding Machine Taps

Jacques Maurel details his holder for larger taps.

PART 2

HOLDING LARGE TAPS

I use quite large taps, up to 24mm in diameter, but only fine pitch (1.5mm) ones.

My usual technique is to push the tap from the tailstock by the tap's rear centre hole, the driving torque is applied to the square end with a lathe carrier, or a spanner, a simple but not very convenient way. I propose a more

convenient attachment (see **fig. 5** and **photo 12**).

A bracket shaft **part A1** is set in the tailstock barrel (the one used by the die holder attachment). This part is used to keep the tap holder **part A2** in line with the lathe spindle.

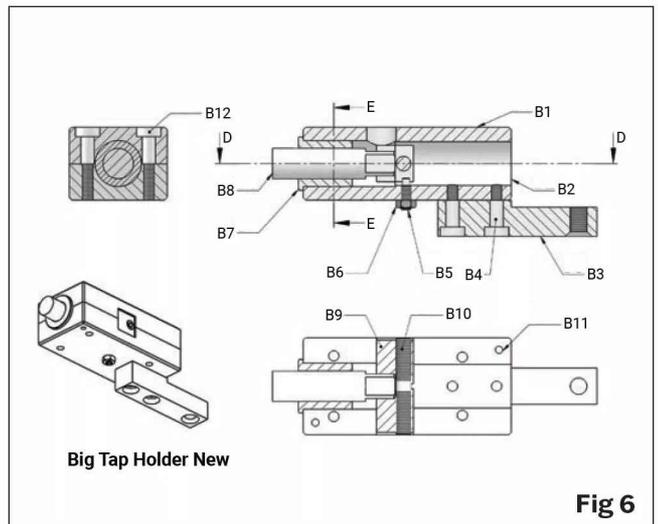
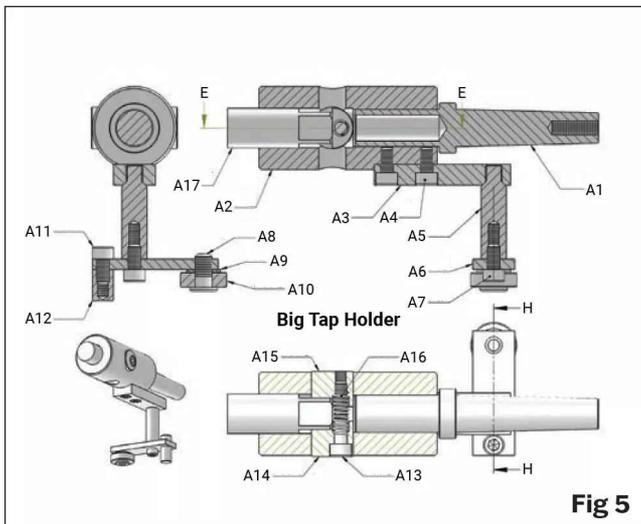
The tap holder has three functions:

- Tap centring: an adapter ring is made for each tap dimension of the set.
- Tap driving: the two jaws **part A14**

and **A15** (not illustrated, see below) are used to catch the rear square part of the tap.

- Torque holding: the stem **A5**, held on **part A3**, takes the torque, a bearing rolling on the lathe shears, **A10**, (when tapping), a bronze pad rubbing on the shears, **A12**, (when tapping out).

The tapping torque is given to the chuck by a tommy bar set in the pinions square holes.



Parts list for the large tap holder:

Ref	No.	Name	Material	Remarks
A1	1	Bracket shaft	FCMS	
A2	1	Tap holder body	FCMS	
A3	1	Torque holding arm	FCMS	
A4	2	Screw CHc M6-10	8-8	
A5	1	Torque holding stem	FCMS	
A6	1	Strip	FCMs	
A7	1	Screw CHc M6-10	8-8	
A8	1	Screw CHc M8-10	8-8	Head machined for ball bearing
A9	1	Washer 8mm diameter		
A10	1	Ball bearing diam 8 diam 22		Width 7mm, protected
A11	1	Screw CHc M6-10	8-8	
A12	1	Slider	bronze	
A13	1	Screw CHc M6-30	8-8	
A14	1	First jaw	FCMS	
A15	1	Second jaw	FCMS	
A16	1	Spring		See text
A17	1	Tap M24x1.5		

MAKING THE LARGE TAP HOLDER:

There should be no problem making these parts. Many parts drawing are not given as they will depend on the dimensions of your lathe.

Spring A16 has external diameter 7.7mm, thread diameter 0.8, 12 turns, free length 32mm. Second jaw A15 is the same as the first jaw A14 but the counterbore is replaced by a M6 tapped hole.

This attachment is not perfect, the jaws can turn in their bore, and can fall-down when no tap is fitted. Hence I had the idea of a new type to avoid these problems but it's more difficult to make.

LARGE TAP HOLDER V2

See **fig. 6** and **photo 13**, the tap holder is made of two shells **part B1** and **part B2** to allow the use of square jaws that won't turn, **parts B9**, a left- and right-hand tightening screw **part B10** is used for clamping. The torque is again taken by a stem identical to that used for the smaller holder so not illustrated, it is attached to **part B3**. A peg-end grub screw B5 is used to avoid losing the jaws.

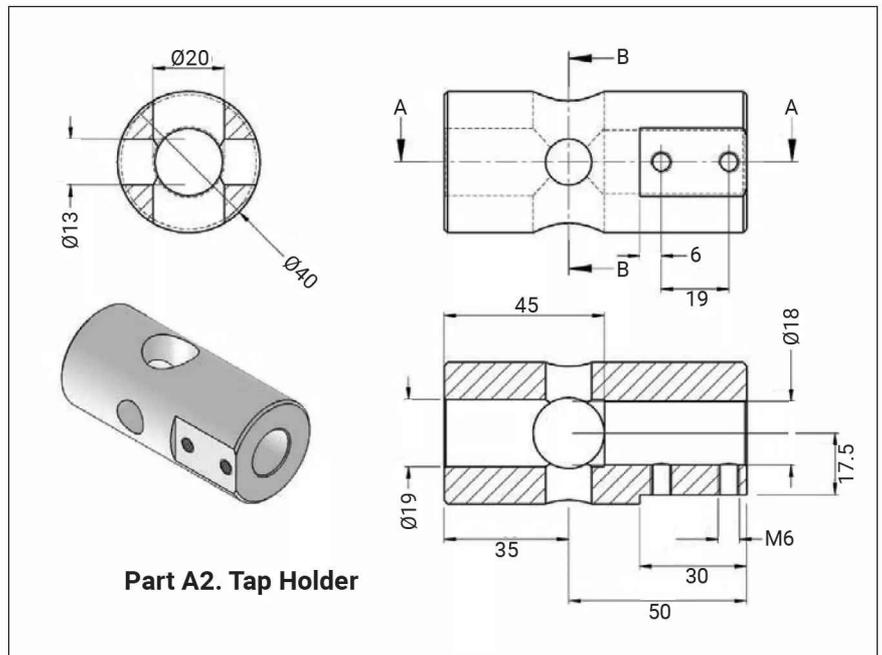
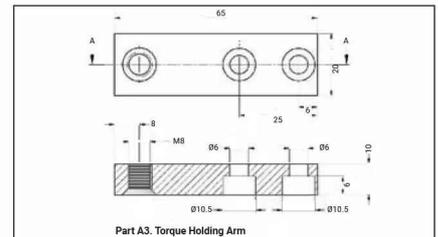
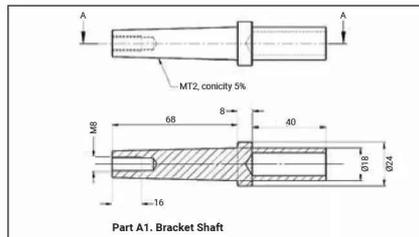


Photo 13: The version 2 holder.

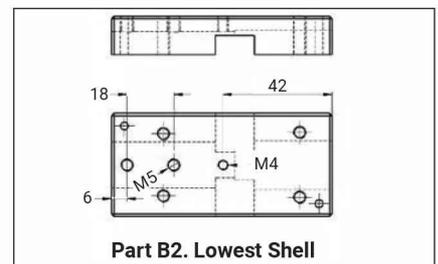
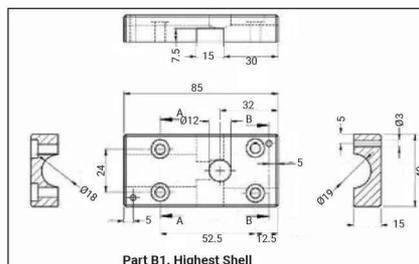
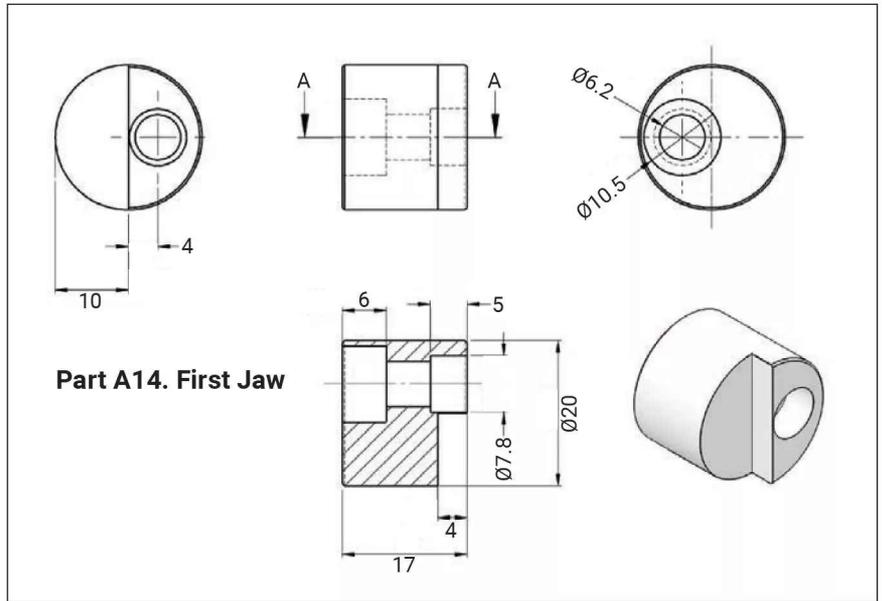




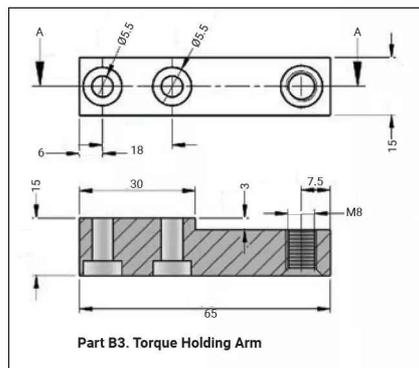
Photo 14: Drilling for the mounting hole.



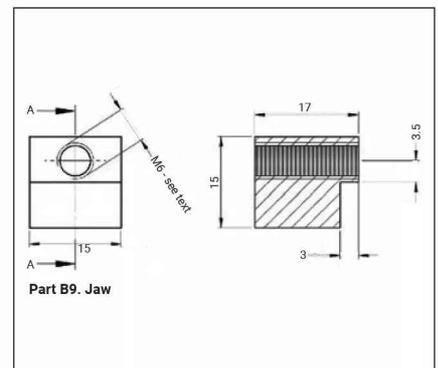
Photo 15: Set up to ensure hole at the opposite end is concentric.



Part A14. First Jaw



Part B3. Torque Holding Arm



Part B9. Jaw

Parts list for large tap holder V2:

Ref	No.	Name	Material	Remarks
B1	1	Highest shell	FCMS	
B2	1	Lowest shell	FCMS	
B3	1	Torque holding arm	FCMS	
B4	2	Screw CHc M5-15	8-8	
B5	1	Screw Hc M5-15	8-8	Peg end
B6	1	Nut H M5	8	
B7	1	Adaptor sleeve	FCMS	See text
B8	1	Tap M14x1.5		
B9	2	Jaw	FCMS	
B10	1	Tightening screw	steel	0.5% carbon
B11	2	Elastic pin diameter 4mm	Nylon	
B12	4	Screw CHc M5-25	8-8	

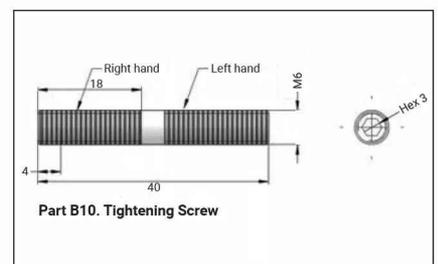
MAKING THE VERSION 2 LARGE TAP HOLDER:

For shells B1 and B2, use 40x20mm free-cutting mild steel, machine to length and the groove for the jaws, make the block with the elastic pins B11 and the screws B12. It's worth using a piece of 15mm square steel for aligning B1 and B2 before joining.

This block is then taken in a four-jaw chuck for drilling the mounting end, **photo 14**, then held from this bore for machining the tap end, **photo 15**.

Individual adaptor sleeves, B7, must be made for each tap stem diameter.

Note that on the jaws, B9, the tapped hole must be made with a right-hand thread on one jaw and a left-hand thread on the other. ●



Part B10. Tightening Screw

MODEL MAKING METALS

1/32in. to 12in. dia. bright steel, stainless steel, bronze, spring steel, brass, aluminium, silver steel, steel tubes, bolts, nuts & screws, tap dies + drills, white metal casting alloys.

Fine materials, chain, plastic.

Lathe milling machines and equipment, new and secondhand.

Mail order nationwide and worldwide callers Mon.-Fri. 9 - 5pm. *All cards welcome.*

Send now for a **FREE** catalogue or phone

**Milton Keynes Metals, Dept. ME,
Ridge Hill Farm, Little Horwood Road, Nash,
Milton Keynes MK17 0EH.**

Tel: (01296) 713631 Fax: (01296) 713032

www.mkmetals.co.uk

email: sales@mkmetals.co.uk



We ship anywhere in the world www.tracytools.com

PRODUCTS

- Taps and Dies
- Endmills
- Centre Drills
- Special Sizes
- Clearance Bargains
- Reamers
- Diestocks
- Slot Drills
- Thread Repair Kits
- Boxed Sets
- Tailstock Die Holder
- Drills
- Tap Wrenches
- Drills HSS
- Thread Chasers

• All British Cycle Threads Available



Drill Sets



Taper Shank Drills HSS



Reamer



Taps & Dies



Tracy Tools Ltd

Tap & Die Specialist, Engineer Tool Supplies

Tel: 01803 328 603 Fax: 01803 328 157

Unit 1, Parkfield Ind Est, Barton Hill Way, Torquay, Devon TQ2 8JG

Email: info@tracytools.com

www.tracytools.com

Look out for your next issue of **Model Engineer & Workshop**

**Number 4775
April 2026**

On sale
**March 20
2026**



Paul Lousick describes his fabricated tool and cutter grinder design with fully detailed drawings.



Mark Thatcher unboxes the 5" Gauge Live Steam BR Class 1500 loco kit from Silver Crest Models.



A reader's build of Paul Buttolph's ML7 clutch published in MEW in 1991 has given 35 years of good service. We revisit this classic design.



To pre-order your next copy of ME&W visit www.classicmagazines.co.uk or call **01507 529 529**



Photo 1: A youthful Roger Backhouse gets practice bricklaying. That was a 1981 project taking out the outside toilet to enlarge the kitchen. Doorway blocked and window inserted.)

Building a workshop from scratch

Roger Backhouse recalls the construction of a bespoke workshop.

During my Ilford days I built a workshop from scratch. In the terraced house where Mr and Mrs Backhouse lived, I used the downstairs front room as a woodwork shop and general store, but after gradually doing up other rooms we decided to restore it as the living room. That meant creating space elsewhere for the workbench and making a place for model engineering, also leaving space for garden tools and produce storage.

The only available land was at the bottom of the garden, a patch not cultivated in recent memory. Our next-door neighbour had a shed in his garden and advised me to build mine as big as possible as he'd had to extend his. That was good advice and the eventual size was 6' wide by 16' long, almost the width of the garden.

Strictly speaking I should have applied for planning permission, but as

neighbours had similar sheds in their gardens, all built without permission, I thought complaints were unlikely. (Outbuildings are considered to be permitted development, not needing planning permission, subject to certain conditions, see www.planningportal.co.uk - Ed.)

Most Ilford terraced houses were built between 1890 and 1910 and rarely have rear access. Everything for the workshop had to be taken through the house, lifting carpet tiles in the hall first.

I cannot claim to have built the perfect workshop and there were several mistakes, but it served my purpose until we left Ilford for York in 2015. My employment was then in public libraries, but I had experience of mixing concrete, building walls and helping with woodwork for my father's home construction projects. So I wasn't the complete innocent and

the library provided helpful books. Earlier I had removed an outside toilet to extend the kitchen, installing brickwork and a window instead of the toilet door. My brickwork wasn't bad, **photo 1**, but I'd never get a job on a building site!

MISTAKE NUMBER ONE

Incredible as it may seem I never drew plans for the workshop. I suppose the plans were in my head. It was a case of 'build and design', but it worked.

First step was taking the rubbish out and levelling the plot, **photo 2**. I hired a skip and also had an offer of clearing rubbish from an itinerant chap, which he did very cheaply though looking back the licence disc on his truck was way out of date and I shudder to think where he might have dumped the rubbish. Still, the job was eventually done, and he loved the garden



Photo 2: Garden view before workshop construction started.



Photo 3: Starting work, foundations part dug.



Photo 4: First course of blocks laid with part of the damp proof course in place.



Photo 5: Laying shed floor. Damp proof course just visible.



Photo 6: Walls part built with doorframe in place

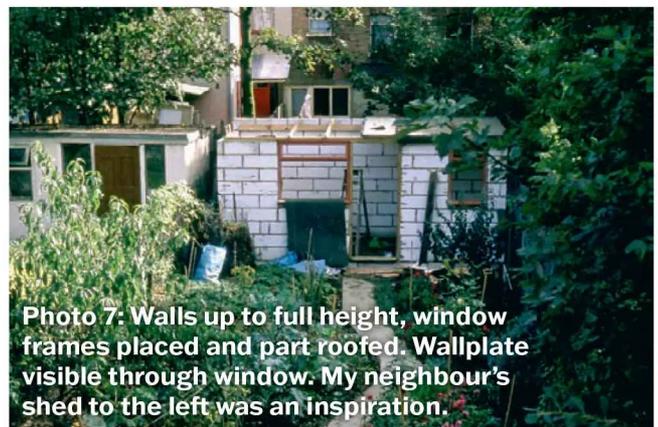


Photo 7: Walls up to full height, window frames placed and part roofed. Wallplate visible through window. My neighbour's shed to the left was an inspiration.

strawberries I gave him.

Next stage was marking out and digging foundations, **photo 3**. 'Ready mix' operations deliver and lay concrete but being short of money and relatively fit I brought bags of ballast (London term for gravel) and cement through the house and mixed them in the garden. I also scavenged hardcore fill from various neighbours and filled the trench with concrete.

For the walls I used Durox aerated blocks. These are relatively light and can be cut. Ideally, they should be rendered if exposed to the elements but in this sheltered location they were rendered on the front and one side only, **photo 4**.

MISTAKE NUMBER TWO

I used sharp sand rather than builders' sand for mixing cement and rendering. This made laying the blocks and rendering more difficult. However, the walls went up with a damp course on the first layer. It was single skin, a cavity wall wasn't necessary given that the blocks were air filled.

MISTAKE NUMBER THREE

After the first courses were laid, I put it down a concrete floor on top of a plastic membrane, a sheet of polythene, that was on top of a mix of hard core and gravel, **photo 5**. The floor

was never quite level despite using quantities of self-levelling floor screed. However, laying 12mm flooring grade chipboard sheets on top covered many deficiencies.

I built up to roof height leaving space for the door and two windows, **photo 6**. As an opening for a window frame was too large I part bricked that up with household bricks salvaged from a wall demolition further up the street, **photo 7**.

MISTAKE NUMBER FOUR

The idea was to have a roof sloping to the front so on the higher back wall I fixed a wooden wallplate to hold rafters

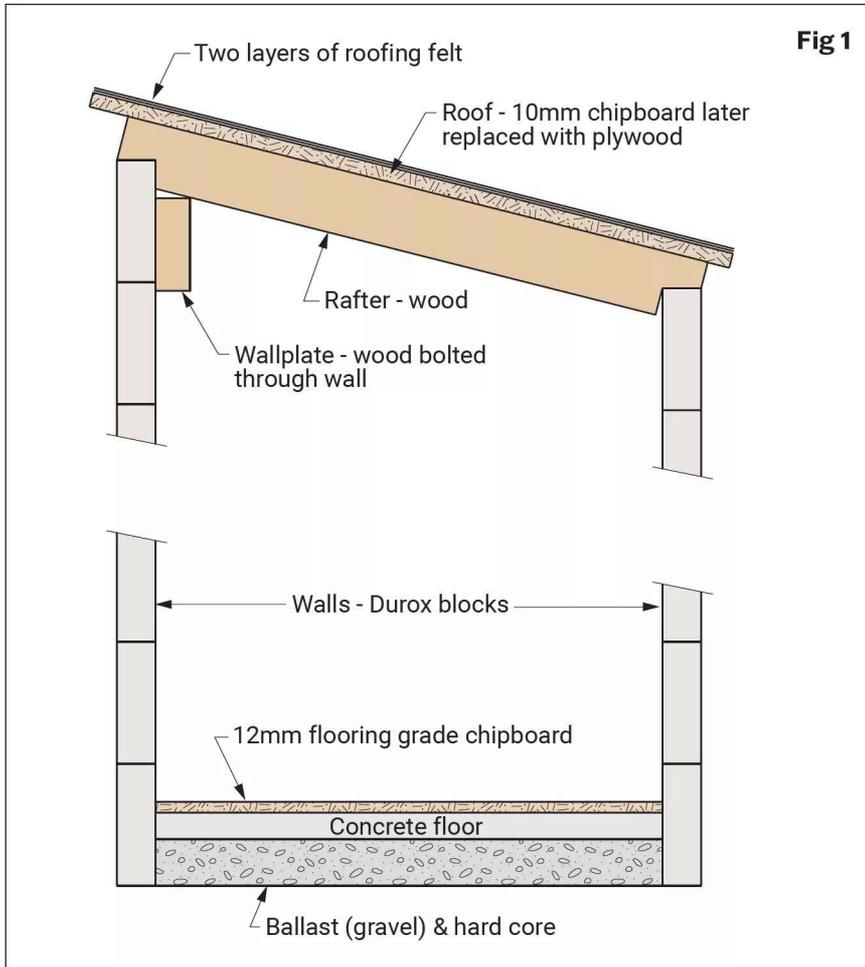


Fig 1

at 2' centres, **fig. 1**. I made the roof with sheets of 10mm chipboard. Ply would have been better but there were no disasters. I felted the roof with two layers of felt stuck to the roof boards, a messy job, **photo 8**.

The two windows came from a local builders' merchant and I glazed them the traditional way with putty. The glazed door was one thrown out from a neighbouring house. I lavished Cuprinol on the door frame and sill in the hope of avoiding future problems with rot and woodworm.

I should have rendered the building as it went up but, in the end, I couldn't reach the back and one side for rendering. If you are rendering use soft (builder's) sand and not sharp sand, and, a tip from a plasterer friend, mix PVA adhesive in to make it stick better, **photo 9**. Plastering is not my strong point so it was a rather rough finish though I preferred to call it 'rustic'.

At work local villains broke into the library safe wrecking it completely (all for no more than £20!) so I brought home the brass door handle along with the safe maker's name plate which I fixed to the door. Later I added the brass 'wheel house' sign, **photo 10**, from my father's workshop which he'd purchased many years before with teak from a ship breaking yard near Neath. It seems an appropriate name for a workshop!



Photo 8: Walls up, window frames installed. Roof finished but tidying needed.



Photo 9: Roofed and front partly rendered



Photo 10: Roofed and part rendered, widows fully glazed.



Photo 11: Finished shed front. The steel wire armoured electric cable enters through the old gas pipe to the left of the door. Two barrels catch rain from the roof - Essex is a dry county and we liked having soft rainwater for the garden.

I started work in June 1982 and by the end of September the structure was finished with walls rendered and part painted. I added gutters and a downpipe feeding barrels, **photo 11**.

Nothing was done over the winter but the following year I dug a trench down the garden and laid a 30-amp steel wire armoured cable which entered the shed through an old gaspipe rescued from a skip. Was a 30-amp supply justified? With voltage drop down nearly sixty feet of garden it seemed sensible. In the immortal words of Roger Ford (Technical Editor of *Modern Railways*) "When it comes to power too much is not enough".

MISTAKE NUMBER FIVE

For some reason I didn't put a ring main in the shed but installed four socket outlets plus a fluorescent tube and incandescent spotlights for the lathe. It was protected by a residual current device at the house and an on/off switch at the shed. All work has to be signed off by a qualified electrician, but I read up on wiring and was delighted when the London Electricity Board approved and connected it to the house main.

I fitted wall battens inside and lined out the shed with a mixture of softboard and block board surplus

to requirements in the kitchen. The ceiling was soft board with rock wool placed between that and the roof. Overall it was reasonably well insulated. On the floor I used flooring grade chipboard given several coats of Sadolin varnish.

An electric fan was the only heating and generally the shed stayed above freezing, important to protect stored potatoes from the allotment, never mind the lathe operator. Later I laid old carpet and installed a chair surplus to requirements at the library. I took it home on the Underground, getting odd looks from home going commuters. One way to get a seat on the tube!



Photo 12: Workbench end with tools and clutter after packing for the move to York. The woodworking bench has already been removed. My wife Margaret made the curtains, transforming the workshop into a “home from home”.



Photo 13: Garden tools and storage, note back copies of *Model Engineer*. (Now I have a full set, essential reading but a great distraction.)

My father and brother Martin made me a woodworking bench some years before and then generously made narrower benches to go round walls at one end, **photo 12**. This was the area



Photo 14: Genuine wheel house sign from my father’s workshop. It originated from a scrapped tanker and now adorns my York workshop.

for wood and metal working.

The other end was storage with space for garden tools, ropes of onions and potato sacks plus shelves for the all-important back issues of *Model Engineer*, **photo 13**. There wasn't enough storage space but there never is. I used lengths of plastic guttering fixed to the wall to hold metals, cheap and effective.

What did it cost? I kept a file of invoices but eventually donated that to Redbridge Local Studies library where it remains (I hope) to this day. Maybe a future historian will find my Pooterish doings interesting, who knows? The contemporary cost would probably be about £2000 - £2500 but it was affordable at the time. I did nearly all the physical work as a reasonably fit 32-year-old but I doubt I'd do the same at 74!

The shed served for over 30 years till we moved north. The only major change in that time was replacing the chipboard roof with 10mm ply and re-felting. When we left Ilford I brought the door furniture with me to adorn the 'new' workshop, a conversion from a garage, **photo 14**. (Perhaps the editor will allow me space to write about that too.)

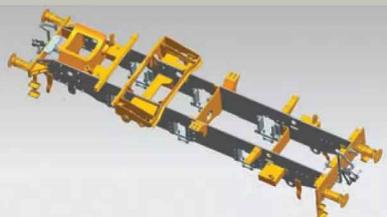
Regrets? Very few. A larger shed would have been even better but would have meant taking more of the garden, and my wife Margaret and I both enjoyed our green space of which there was too little in Ilford. Building it another foot higher would have increased storage space but that would not have been easy when working from a stepladder. And as a do-it-yourself job it saved a lot of money! 🍷

MARKET LEADER IN LARGE
SCALE, READY-TO-RUN,
LIVE STEAM

LAST FEW MODELS AVAILABLE. ORDER NOW!

GWR 15xx CLASS KIT FOR 5" GAUGE

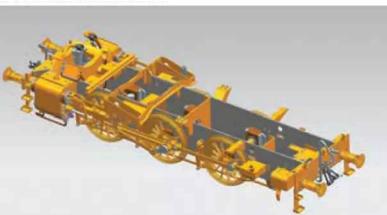
£6,495 + £195 p&p



Kit 1 Shown Assembled



Kit 1 & 2 Shown Assembled



Kit 1, 2 & 3 Shown Assembled



Kit 1, 2, 3 & 4 Shown Assembled



Kit 1, 2, 3, 4 & 5 Shown Assembled



Kit 1, 2, 3, 4, 5, & 6 Shown Assembled



See YouTube build video's. **Over 120,000 views!**
www.youtube.com/@MADforSTEAM

Summary Specification

- 5" Gauge, coal-fired, live steam
- 2 outside cylinders
- Outside Walschaerts valve gear
- Stainless steel motion
- Silver soldered copper boiler
- Boiler feed by axle pump, injector and hand-pump
- Multi-element superheater
- Drain cocks
- Safety valve
- Etched brass body
- Choice of liveries
- Mechanical lubricator
- Reverser

Approximate Dimensions

- Length 35"
- Width 10"
- Height 14"
- Weight 51kg

The GWR 15xx Class

All ten locomotives of the class were constructed in 1949 at Swindon and entered service on the Western Region of British Railways. They were employed on heavy shunting duties at London Paddington.

The 15xx Model

We are delighted to report that our fully machined, bolt-together, kit of the GWR15xx has proved to be a great success. The quality is superb and this has enabled many customers to assemble their model quickly and get out on the track. It is suitable for the novice builder who will benefit from illustrated assembly instructions and a telephone helpline if advice is needed. The complete kit is delivered in a single consignment fully painted in unlined, or lined, black livery with the number of your choice. The 15xx is also available as a factory built ready-to-run model for an extra £500. Boilers are silver soldered and UKCA marked. All models benefit from a 5 year warranty.



15xx model in
BR Black livery

"I am absolutely delighted with my 15xx model. It is perfect in every detail. Silver Crest Models have been a pleasure to deal with."

S. H. (Banbury)

Delivery and Payment

Save £195.00. Free p&p for any order received within 28 days.

The manufacture of the batch is now complete and models are ready to ship from our supplier. Payment in full is required with your order.



Please send, without obligation, my free 15xx Class brochure.

Name: _____
Address: _____
Post Code: _____

Please send to: Silver Crest Models Limited,
2 Gresley Close, Daventry,
Northamptonshire NN11 8RZ

ME&W

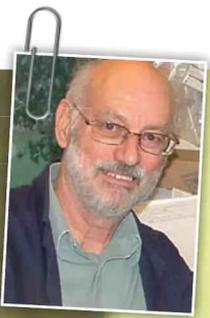
Company registered number 7425348

Request your free brochure today

Request your free brochure today by e-mail, telephone, or by returning the coupon opposite.

Telephone: **01327 705 259** E-mail: info@silvercrestmodels.co.uk

Find more information at www.silvercrestmodels.co.uk



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

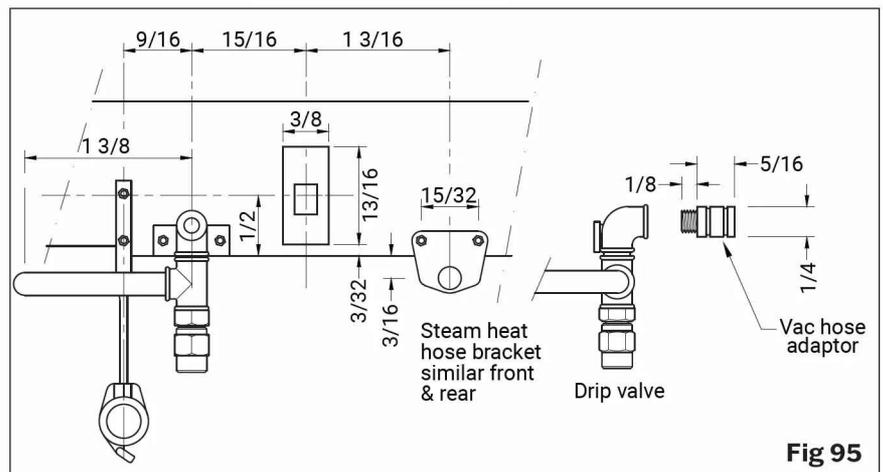
PART 25



Doug Hewson
describes the
vacuum ejector.

Photo 240: Drilling ejector housing casting at an angle.

I would like to deal with the vacuum ejector now, as this is part of the smokebox barrel to me. I made patterns for this set years ago, as part of the patterns for my 4MT and one of the things that amazed me was that several people rang me to say that did I realise that the ejector drew the same vacuum as the full size engine, 25". My reply was one of staggered amazement! Anyway, I saw one or two in action which confirmed it. I know that the BR engines have the vacuum generally set to 21" apart from the ex-GWR and Western Region engines which are set to 25" of vacuum. I think that we settled on 10" of vacuum, apart from those of us who use 16" as we couldn't get much life out of the vacuum if it was set at 10". I have eleven vacuum fitted wagons and an LMS 50ft Full Brake which has wonderful vacuum brakes. In fact, all my wagons have good vacuum brakes. I must say that it is fascinating to watch the brake



linkage drop down when the vacuum is applied and also quite fascinating to watch the brakes come on if the driver has a signal check. One only has to drop the vacuum by an inch, and my brakes make a lovely squeal when that happens. We fitted vacuum

brakes to a GWR Hall and took it to Gilling for a trial. We had also built the gent who owned it one of our Southern bogie parcel vans which also had new vacuum brakes. I took it down the long headshunt and then propelled it up the 1 in 100 head shunt, put the brakes



Photo 241: Drilling the back.



Photo 242: Finished ejector housing.

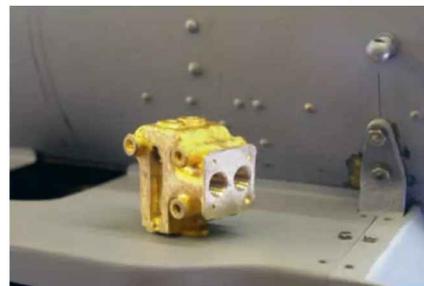


Photo 243: How the opposite side should look.

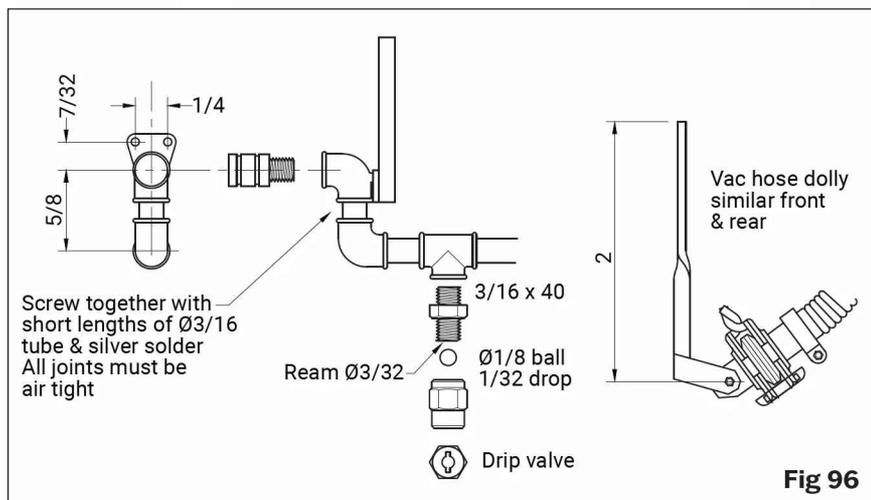
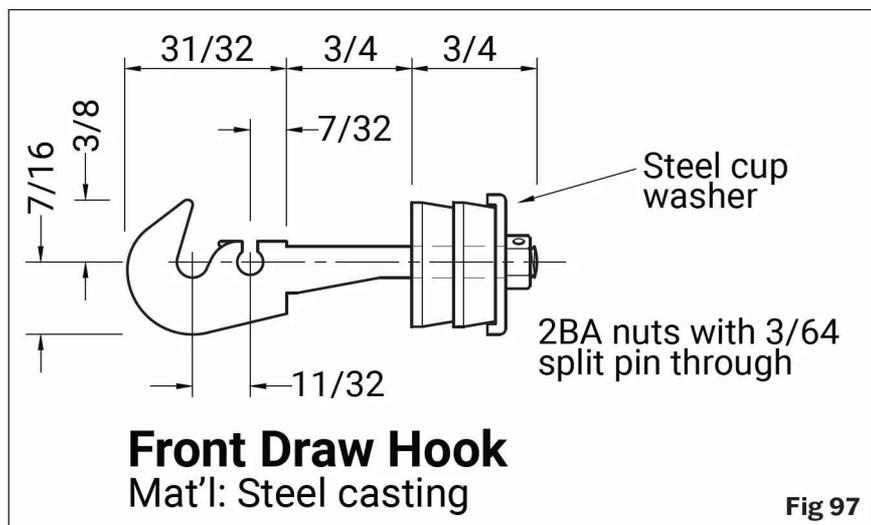


Photo 244: Ejector in place.

had already said about how the ejector had performed. Sorry DAG! We will carry on with the ejectors themselves now and if you take note of what I have said about the cones and the drawings you can carry on and make them. When I say that the cones need to be a press fit in their housings, I mean that they should be a very light press fit, or you could use a small bead of Loctite. Nothing too permanent. The length of the pipe which connects the ejector to the vacuum exhaust elbow, **photo 244**, needs to be about $1\ 7/8$ " long. There are two side cheeks to silver solder on and these need to be vacuum tight. They carry the vacuum around the body to the train pipe which is connected to the train pipe which is attached to the underside or the casting via a triangular flange or a union depending on where you look. If you have a look at the earlier photos which appeared in part 23 you will see the various configurations. The pipe from the ejector goes to the pedestal in the cab, which we will get on to in the fullness of time. All of the vacuum piping is 2" steel pipe and that means to you and me it should be $7/32$ x 26swg copper tube. I think that all of our distributors will hold their hands up and say no can do.

This was what is known as one of my two phone call jobs. The manufacturers I spoke to said that "Oh, the smallest tube we make is 6" diameter, but you need to speak to so and so and he will fit you up. He said that the smallest we make is $1/32$ " diameter. I bought a stock of tube from him, and it was from $1/32$ " diameter to $1/4$ " diameter all in thin-walled copper except the $1/32$ "



Front Draw Hook

Mat'l: Steel casting

on outside Erimus Signal Box and it stopped dead. I had not realised that the buffers had also compressed but when I let the brake off the buffers just opened up to their full extent. I thought that this was wonderful.

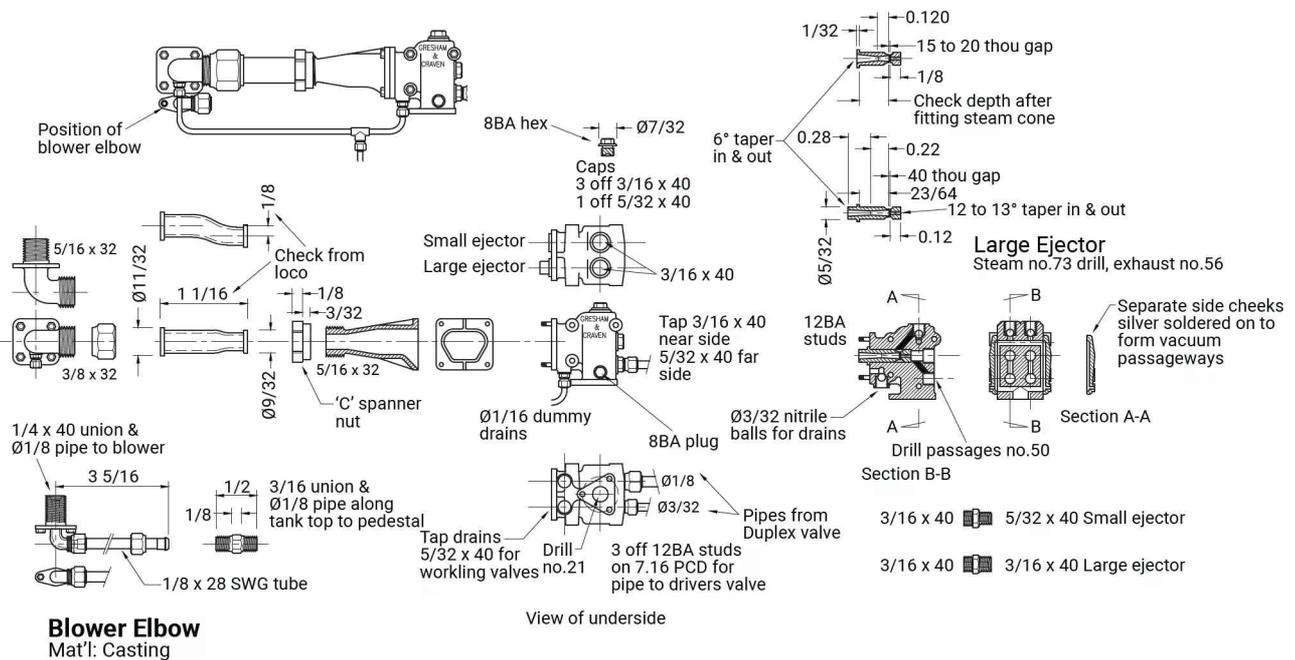
To make a start on the ejector housing, I drilled all the holes out and tapped them to the appropriate sizes and cleaned up the faces. **Photograph 240** shows the casting held at an angle whilst I drilled the passageways down to the ports where the ejectors were situated. Of course,

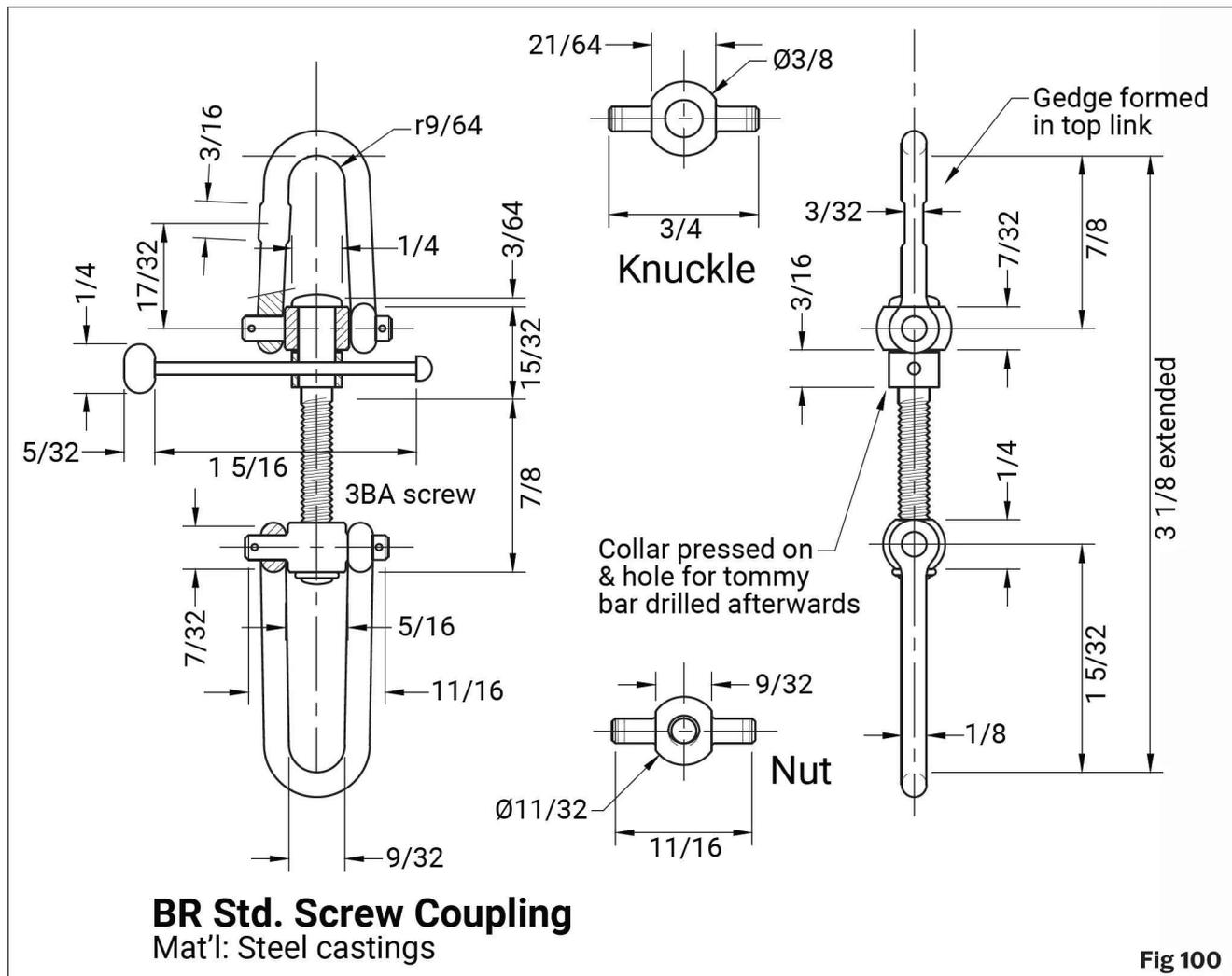
the duplex valve will determine which ejector will work, but that is for later. **Photograph 241** shows me drilling out the holes for the connections on the back of the ejector. **Photograph 242** shows the completed job with all the holes drilled and tapped. **Photograph 243** shows the other side of my ejector with holes for a good press fit for the ejectors which are on my drawing. D.A.G. Brown gave me some alternative tapers for my ejector, but I had already finished it so I left it as it was, bearing in mind what other people

Fig 98

Pipe Size	0.054	1/16	3/32	1/8	5/32	3/16	
Hexagon Size	6BA	5/32	3/16	1/4	9/32	5/16	
Thread Size	6BA	1/8 X 60 or 40	5/32 X 60 or 40	7/32 X 40	1/4 X 40	9/32 X 40	
Union Nuts	6BA						
		Note shape of union nuts					
Back Nuts	6BA						
Nipple Size		5/64	3/32	5/32	3/16	7/32	
Gland Nuts For Spindle Size					1/16	3/32	

Fig 99





diameter, which was in brass, but it was not seamless. I was quite amazed at how much we sold. I asked him what the smallest seamless copper tube he could make is, and his reply was 0.054" diameter, so we always kept a good stock of that when I had my shop. I was very sad when he announced his retirement although he recommended someone else. I recommended it for all the grease pipes on my 4MT.

Now, I think we need a word or two about union nuts and cones. I get the impression that a lot of model engineers think that the smallest union nut and cone is 1/4" x 40. I have news for you, it isn't. On my locos I have used anything down to 6BA union nuts and they were designed for the 54 thou pipe that I used to try to get the pipework down to scale. The thing was that in one of my lubricators I was using SAE30 oil for lubricating the slide bars and valve guides. I used to set to and make them in batches of about fifty at a time so that they would last me a while. **Photograph 245** shows some 6BA union nuts on the atomisers on

my 4MT. To this end I have included a table to show you the sizes of the nuts and cones that I use.

I will just get one more thing out of the way and that will be the pair of screw couplings and other bits and pieces which go with them. The couplings are British Standard types so they need a gedge in the top link so that they can be dropped into the hook once the top link has been turned into the horizontal position. There should be a casting set for these if The Steam Workshop still see them, so that they only need the screws turning. I have recommended a 3BA screw as that is dead to scale. On the end of the screw, you will also need to turn a 1/8" diameter pip on it and rivet a 5/32" x 1/16 rounded collar on it, otherwise you will be very cross when you lose the shackle off the end.

I thought that it might be nice to complete the decorations on your front buffer beam, so I have included the drawings for those like the draw hooks and screw couplings, plus the pipework and fittings to make them all work. If

you are intending to make your vacuum brakes work, then the drip valves need to work too. Having said that there is not a lot of work in making them work! I have also included a little drawing of the correct shape figures for your smoke box number plate. If anyone is building any of my locos it would be very nice to see some progress photos of your engine, and a bit about them.

To be continued



Photo 245: 6BA unions on 4MT's atomisers.

On the Wire

News from the world of engineering

Host Club Sought for IMLEC 2026

Despite some expressions of interest at last year's event, and further contact with several clubs around the UK, we have been unable to secure a venue for this year's International Model Locomotive Efficiency Competition, although we do have firm offers for future years. We are urgently seeking a Club willing and able to host the event in 2026.

The competition requires a venue with both 3 1/2" and 5" gauge tracks, ideally with a range of track conditions, and the capacity for good numbers of locomotives to steam up at the same time and safe viewing for spectators. Ideally the event would take place in late July, however, we are willing to be flexible

to ensure this prestigious event takes place this year.

The Fareham club, who hosted last year, and a number of other individuals are happy to offer help and support to any club willing to take on the event. Please could any club interested contact the Editor for more details: neil.wyatt@kelsey.co.uk.



NASA delays first crewed Moon mission for over Fifty Years

NASA concluded a wet dress rehearsal for the agency's Artemis II test flight around the moon early on 3 February. Although successfully loading cryogenic propellant into the SLS (Space Launch System) tanks and safely draining the rocket, issues with hydrogen leaks were detected. To allow teams to review data and conduct a second wet dress rehearsal, NASA now will target March as the earliest possible launch opportunity for the flight test.

Newcomen Steam Festival - Dartmouth, 25 July



The Railway 200 event in 2025 began as a small idea rooted in a personal passion. Colin Chapman is a lifelong railway enthusiast and model engineer, currently building a model railway in his loft. When he and his daughter, Abi, became aware of the Railway 200 campaign, they recognised it as a fantastic opportunity to celebrate railway heritage while also supporting local businesses and boosting tourism in their small town. With the support of the Chamber of Commerce and a growing relationship with the Dartmouth Tourism Board, the idea quickly gathered momentum.

What started modestly soon developed into a large-scale event, attracting over 500 visitors to the Guildhall in Dartmouth. Exhibitors included local steam heritage railways, Network Rail, a model railway society, and displays exploring Dartmouth's historical



connection to steam. The day featured talks, a timeline tour of the town's railway and steam heritage, a miniature sit-on railway, and the Dartmouth Museum's display of the Hulse models. The response from both exhibitors and visitors exceeded all expectations and demonstrated a strong appetite for engineering, steam, and railway heritage in the area.

Building on that success, they are now launching the Newcomen Steam Festival, which takes place



on Saturday 25th July in Dartmouth, Devon. This will be the first festival following the Railway 200 event and will celebrate Dartmouth's pivotal role in the history of steam and engineering, particularly its connection to Thomas Newcomen. The festival aims to educate, inspire, and entertain visitors of all ages through exhibitions, talks, demonstrations, and interactive activities, while supporting the local economy and strengthening community and heritage partnerships.

INTERMODELLBAU 2026

Once a year, the world's largest exhibition for model making and model sports takes place in Dortmund and opens its doors to everyone interested in experiencing the world scaled down to miniature proportions. Here, a huge range of exhibitors, models, layouts and products from all over the world delight experienced model builders, new enthusiasts as well as the entire families. Whether it is aircraft, railways, boats, ships or cars – either working

models or cardboard modelling – there is something for everyone. Visitors can also experience model making – literally – at first hand at Dortmund Exhibition Centre, as numerous hands-on activities, demonstrations and feature shows await them at INTERMODELLBAU. The high number of bookings at the end of the year already promises a first-class field of exhibitors. Many companies have even increased their stand space compared to last year,

while other companies are participating for the first time.

This year, the colourful world of circus and fairground model making, which never fails to delight visitors, will be expanded. Among others, Stephan's Kirmeswelt and Kirmesmodelle Raue will be presenting their creations, ensuring sparkling eyes among fairground fans of all ages.

For more information and tickets visit www.intermodellbau.com.



Where small things are king.

The world's largest exhibition for model building and model sports

16–19 April 2026

Messe Dortmund, Germany



Garden Railway Specialists

KINGSCALE



GWR King, 5 Inch Gauge,
GWR Lined Green
£12,500.00



Streamlined Coronation,
5 Inch Gauge, LMS Blue
£14,995.00



Gresley A3, 5 Inch Gauge,
'Flying Scotsman' BR Green or
LNER Apple Green **£13,995.00**

Station Studio, 6 Summerleys Road, Princes Risborough, Bucks, HP27 9DT
E-mail: sales@grsuk.com Website: www.grsuk.com Tel: 01844 - 345158
Monday - Friday 09:00 - 16:00hrs Saturday 10:00 - 16:00hrs

ALL LIVE STEAM ENGINES WANTED

ANY SIZE & CONDITION INCLUDING PART BUILTS



Stationary Engines inc. Stuart Turner, Bing etc
Traction Engines and Locos in all sizes.
Especially wanted 4" and 4½" gauge Traction Engines.
Any Locos from gauge 1 to 7¼".
Also any Electric models locos, buses etc
Will collect personally. Distance no object.



Call Kevin on 01507 606772 or 07717 753200

MAXITRAK & ACCUCRAFT UK

The best of model rail and road.



Live
Steam!



Accucraft UK
16mm & Gauge 1



New Maxitrak Wren
5" Gauge, Coal Fired
Live Steam!
Kit or Ready to Run



5" & 7 1/4" Gauge
Kits & Ready to Run Models



3/4" DG6
Sentinel Lorry



maxitrak.com **01580 893030** info@maxitrak.com



MAIDSTONE-ENGINEERING.COM
One stop model engineering shop
For Maxitrak & Accucraft Models.
Leading suppliers of fittings, fixings,
brass, copper, bronze & steel

MAIDSTONE
ENGINEERING
SUPPLIES

Tel: 01580 893030 Email: info@maidstone-engineering.com
Visit us: 10-11 Larkstore Park, Lodge Road, Staplehurst, Kent, TN12 0QY

Club Diary

Please send your events for Club Diary to meweditor@mortons.co.uk

2026

Every Sunday

Urmston & District MES

Public Running every Sunday
Contact: secretary@udmes.co.uk

Warrington MES

Running day. Contact : contact@wdmes.org.uk

Wakefield SMEE.

Public running day. Contact Denis Halstead 01924 457690

February

15 Stafford & District MES

Steam up, County Show-ground, Stafford, 10:00 am. See www.sdmes.co.uk or Facebook.

21 Gauge 1 Yorkshire Group

Running day at Drax Power Station social club, 9:30 - 15:30. Contact secretary@gauge1north.org.uk

March

4 Leeds SMEE

Wanless Trophy. Darrington Golf Club, 7pm.

18 Leeds SMEE

Judith Bellamy - Keynan Railways (Nairobi Railway Museum). Darrington Golf Club, 7pm.

21 Gauge 1 Yorkshire Group

Running day at Drax Power Station social club, 9:30 - 15:30. Contact secretary@gauge1north.org.uk

22 Stafford & District MES

Steam up, County Show-ground, Stafford, 10:00 am. See www.sdmes.co.uk or Facebook.

22, 29 Bristol SMEE

Public Running day, Ashton.

April

1 Leeds SMEE

Ian Sparks - Day with Rocket. Darrington Golf Club, 7pm.

5, 16, 19 Bristol SMEE

Public Running day, Ashton.

8 Saint Albans and District MES

Auction with auctioneer Guy.

19 Stafford & District MES

Steam up, County Show-ground, Stafford, 10:00 am. See www.sdmes.co.uk or Facebook.

19 Bradford Model Engineering Society

Public running day. Members from 11:30 am, public from 1:30 pm to 16:00, whatever the weather, Northcliff. Contact: Russ Coppin, 07815 048999.

May

3, 4, 24, 25 Bristol SMEE

Public Running day, Ashton.

6 Leeds SMEE

Jack Salter - What I Did last Summer. Darrington Golf Club, 7pm.

17 Bradford Model Engineering Society

Public running day. Members from 11:30 am, public from 1:30 pm to 16:00, whatever the weather, Northcliff. Contact: Russ Coppin, 07815 048999.

23-24 Bradford Model Engineering Society

Event at Bradford Industrial Museum

June

5-7 Cardiff Model Engineering Society

34th Welsh Locomotive Rally Heath Park, rally@cardif-fmes.com.

7, 14, 28 Bristol SMEE

Public Running day, Ashton.

10 Saint Albans and District MES.

Puffing Field, depending on weather. Alternate July

13-14 Rugby Model Engineering Society.

Sweet Pea Rally, To be held at Rainsbrook Valley Railway.

20-21 South Cheshire Model Engineering Society

LittleLEC annual locomotive efficiency competition, Willaston, near Nantwich. littleLEC@gmes.org.uk.

21 Bradford Model Engineering Society

Public running day. Members from 11:30 am, public from 1:30 pm to 16:00, whatever the weather, Northcliff. Contact: Russ Coppin, 07815 048999.

July

5, 26 Bristol SMEE

Public Running day, Ashton.

8 Saint Albans and District MES.

Puffing Field, depending on weather. Alternate June.

19 Gauge 1 North

Live steam on the Ridings track, traders and society stands North, Agriculture and Business Centre, Bakewell. Contact: secretary@gauge1north.org.uk

19 Bradford Model Engineering Society

Public running day. Members from 11:30 am, public from 1:30 pm to 16:00, whatever the weather, Northcliff. Contact: Russ Coppin, 07815 048999.

August

2, 30, 31 Bristol SMEE

Public Running day, Ashton.

16 Bradford Model Engineering Society

Public running day. Members from 11:30 am, public from 1:30 pm to 16:00, whatever the weather, Northcliff. Contact: Russ Coppin, 07815 048999.

September

13 Bradford Model Engineering Society

Public running day. Members from 11:30 am, public from 1:30 pm to 16:00, whatever the weather, Northcliff. Contact: Russ Coppin, 07815 048999.

13, 20 Bristol SMEE

Public Running day, Ashton.

26-27 St Albans and District Model Engineering Society

The BIG St Albans Model Show.

October

3 (TBC) Bradford Model Engineering Society

Visitors Day. BMES welcomes members and their locomotives from other societies to Northcliff for breakfast & lunchtime buffies. Let Russell know in advance, please: Russ Coppin, 07815 048999.

11 Bradford Model Engineering Society

Public running day. Members from 11:30 am, public from 1:30 pm to 16:00, whatever the weather, Northcliff. Contact: Russ Coppin, 07815 048999.

14, 18, 25 Bristol SMEE

Public Running day, Ashton.

17 Gauge 1 Yorkshire Group

Running day at Drax Power Station social club, 9:30 to 15:30. Bar open for drinks, breakfasts and lunch. All welcome.

A Belt Tension Locking Handle



Graham Meek shares an elegant design that simplifies belt tensioning the Proxxon PF 230 / FF 230 Milling Machine.

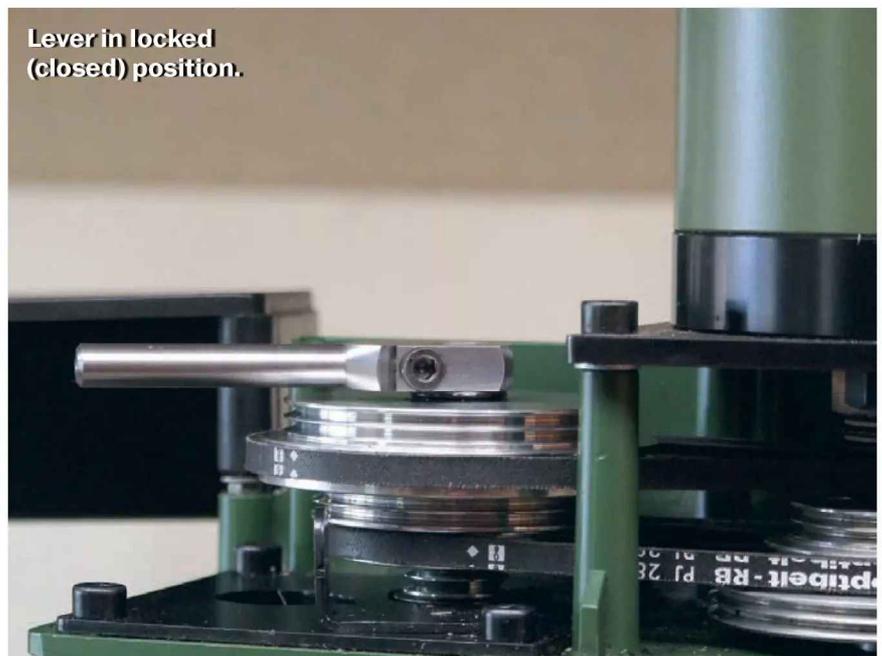


Lever in unlocked (open) position.

There comes a time when searching for an elusive Allen key loses its fun value and becomes more of a drudgery. Such was the case with the Proxxon belt adjustment on the FF 230 Milling machine. My patience had been exhausted, and it was time to make using the machine more efficient. Having the locking mechanism already fitted to the machine means that once the belt cover is opened. The only thing required is to unlock this mechanism, change the belt position and then re-lock.

It had been a long-term wish to incorporate an adjustable locking handle beneath the guard on this machine for this purpose, **photo 1**. Space is tight to say the least, so this ruled out any proprietary lever. That is without having to modify the belt cover. After an evening doodling, the design here was arrived at, **fig. 1**. A further session in the workshop one Saturday yielded levers for both my machines.

The lever when fitted also has an inbuilt safety feature in that the belt cover cannot be closed until the lever is locked, **photo 2**. No turning the machine on with the belts loose.

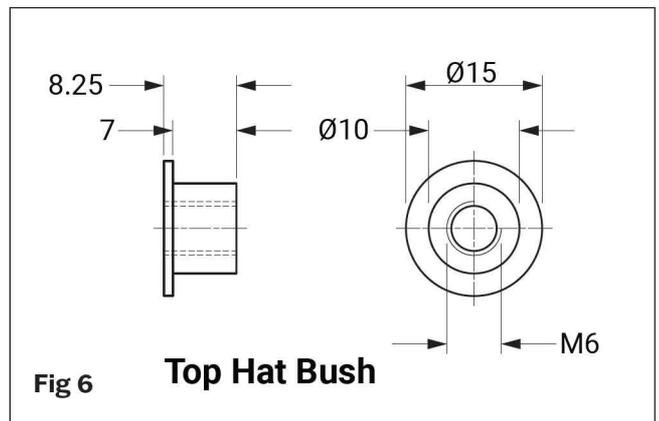
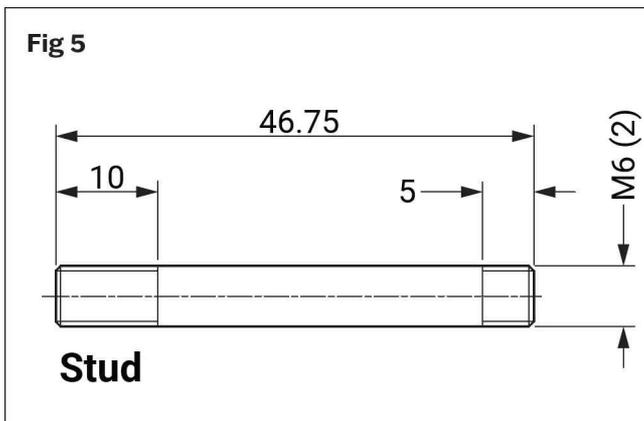
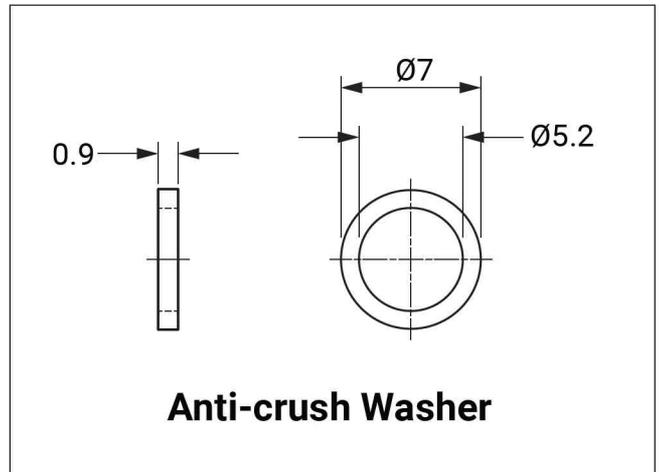
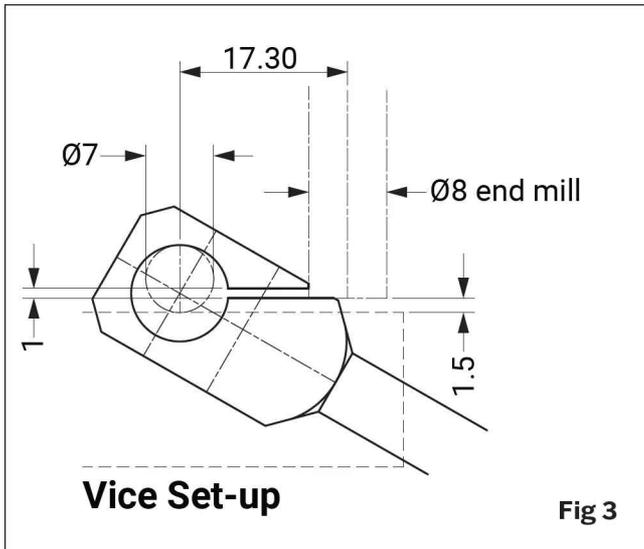
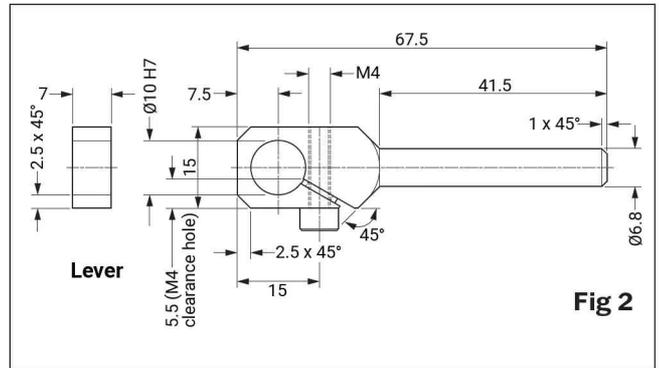
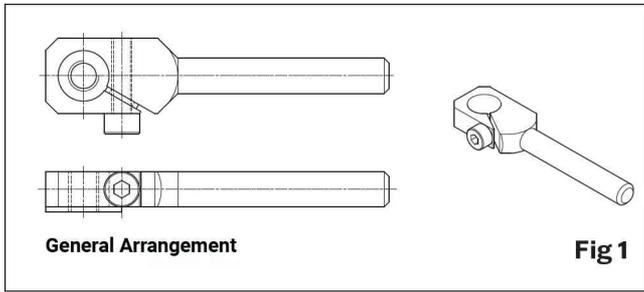


Lever in locked (closed) position.

Something that could happen with the original set-up. Believe me, I know.

There is an added bonus in the replacement of the M6 Capscrew which Proxxon uses with a bespoke

M6 stud. In that it stops the belt pulley from tilting over and doing an impression of a jelly on a plate during the belt changing process. Not the best situation when trying to get



70-year-old fingers to manipulate a small section Poly-Vee belt. The lever, **fig. 2**, was turned from a free-cutting mild steel round bar. While flat stock could be used, it would not give such a good finish and there would be problems as regards distortion once the stresses in the bar were released. There is a drawing included to show a simple set-up for machining the 1mm wide slot, **fig. 3**. A 7mm diameter drill shank in the 10mm reamed hole rests on the top of the machine vice. Setting the lever at the requisite 30 degrees means the slot is 1.5mm above the vice jaws. The 8mm endmill removes the sharp edge left after the slitting operation, but this is performed first.

After the slitting this edge will flap around under the 8mm endmill and could cause a calamity. The step produced makes locating the slitting saw easier. Readers might be wondering what the 0.9mm thick small washer is for, **fig. 4**. This is inserted into the 1mm wide slot before inserting the M4 capscrew. Its purpose is to stop the clamping element from distorting and make the clamping action more effective. To ensure the stud was truly perpendicular in the Proxxon Tee Nut, the M6 stud, **fig 5**, was screwcut. It also gave a chance to make the fixed thread a better fit in the Tee Nut. The top hat bush, **fig. 6**, is screwed to the top of the stud, and the

lever fits over it so it can be secured at the correct angle. Not shown in the photographs is that the levers were eventually "Blackened". For this I now use Jenolite Koldblak, (usual disclaimer). For the price it gives very good results. Some solution mixed and stored in a plastic container usually lasts a year. It does however need to be used within the temperature range or the colour is not so good. Of course, there is no reason why this design of locking lever cannot find a use on other machines, or for other purposes. Scaling the dimensions will yield levers suitable for other thread sizes. ●

A GWR Pannier Tank in 3 ½ Inch Gauge

PART 22

Gerald Martyn completes the construction of his 'engine I could carry'.



Photo 173: Ready in the steaming bay.

At this stage it's usual to just want to see your new engine running, so I've specified purchased drain cocks to save time. These are not, of course, GWR style and I hope to be able to design something better as an 'improvement'. Another problem is that in spite of specifying threads for the smallest available drain cocks the operating levers are 5/16" long and more suitable for larger sizes, rather than the ones with ¼" levers that used to be available. Standardisation, I guess, to the detriment of smaller engines again. This means that the operating levers come very close to the front wheels and this restricts movement a bit. To make the best of the situation the design shows the levers forward for cocks open which is not my normal practice, because 'open' requires a full 45° lever angle whereas 'closed' does not. A point I will make without apology is that all the pivot pins are simply screws, small hex 10BA for the lever to rod connections and 7BA countersink



Photo 169: Levers at various stages of completion.

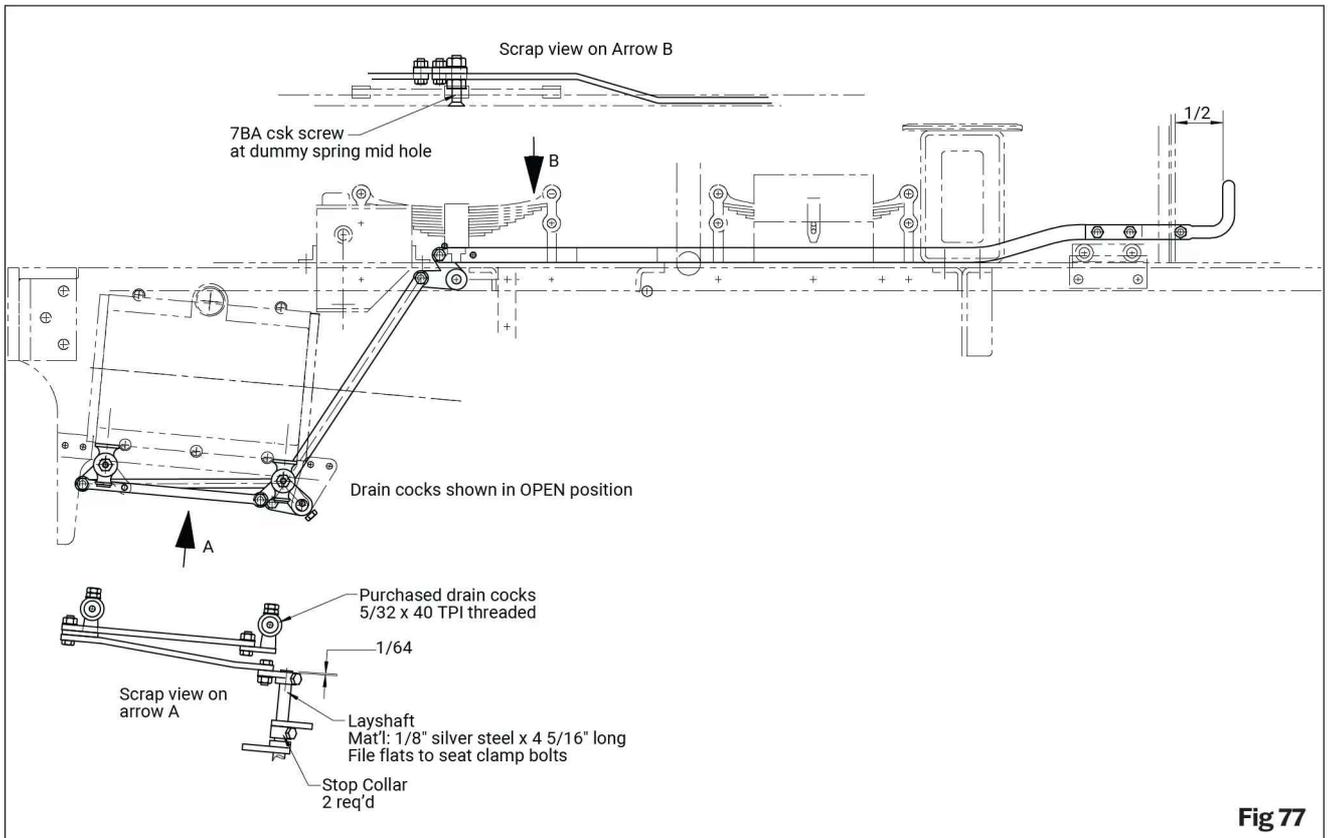


Fig 77



Photo 170: Assembled drain cock levers and rods.

for the bellcrank pivot. Not good engineering practice but simple. The loads are trivial and they are only operated once per steaming so will last out the engine. On the prototype the long pushrod runs below the frames on the right-hand side, just above the brake equaliser beams. On the model the brake pull rods and their pins already occupy this space. Instead, then, I've run a rod unobtrusively above the footplate behind the toolbox etc. on the left hand side to a bellcrank behind the front dummy spring. Our sixteen-times too large fingers should be able to operate it from within the cab. The assembly drawing is shown in **fig 77**. For this assembly I've shown all the pins and pivot screws to make clear how they assemble as it's fairly important to get them the right way round.

The detail parts are shown in **fig 78**. The little levers and the bellcrank are best made in two parts, a piece of cut-out sheet steel for the arm drilled to take a small bush which forms the round boss, which is then silver soldered in. There are three levers the same to make and **photo 169** shows these at various stages; rough cut lever with bush ready, bush soldered in, and finished. For the rods I've specified 1/16" bright mild steel bar. At first glance they look ideal for laser cutting, but the only material available in the right thickness is CR4 steel which is far

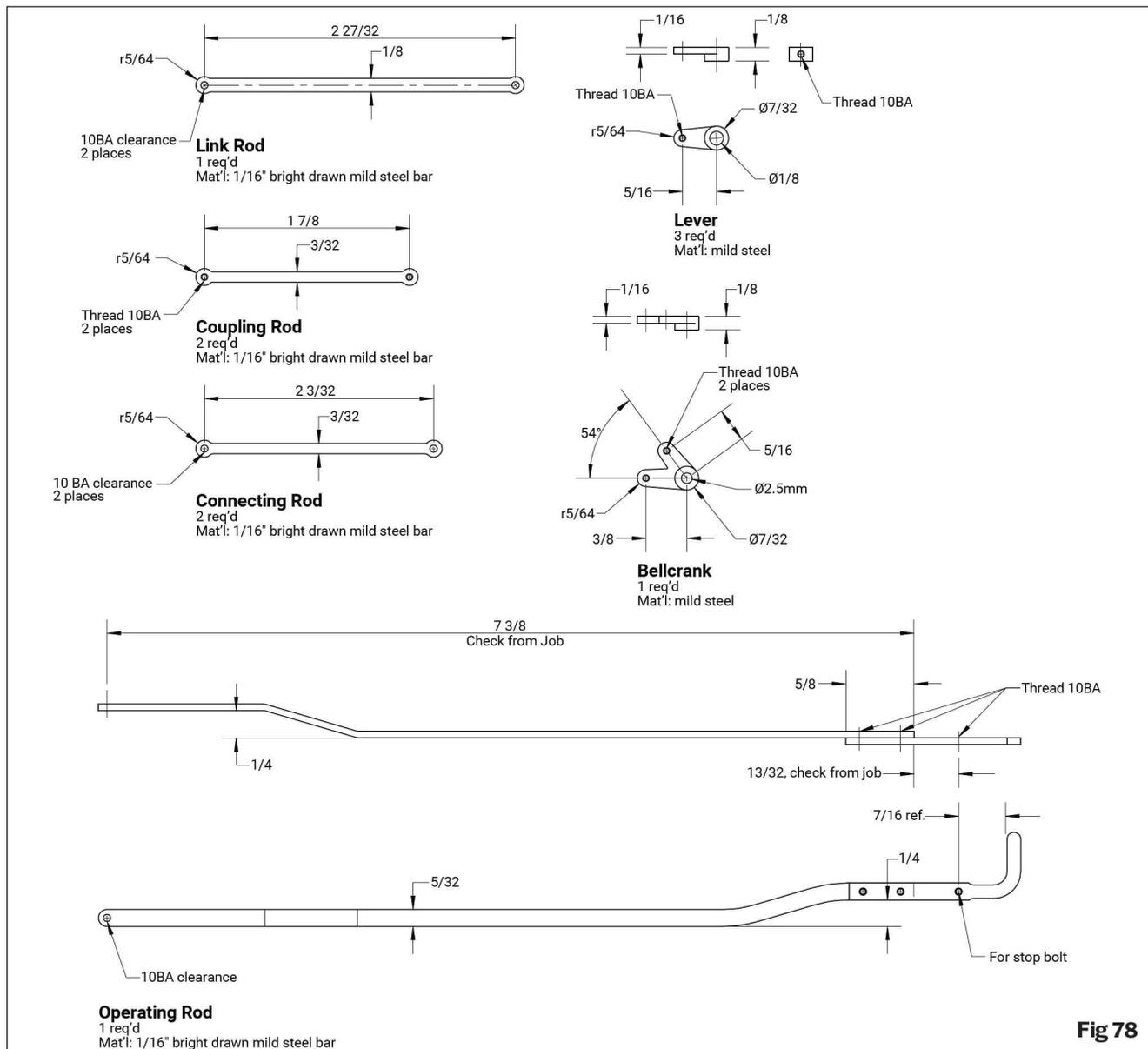


Fig 78

too soft and for these slender rods will bend at a touch. So a bit of hacksawing and filing is required. After cutting 5" gauge engine frames this way these little bits are a breeze.

Assembly is a fiddly job, and those artery forceps will prove useful. The operating pushrod front pin can be installed with the rod in the forward position using a box spanner in the space below the spring to screw the bolt into the bellcrank, and the nut on the back held with forceps and picked up as the bolt comes through. Final tightening has to be done with a spanner between the frames from below. The nuts here and on the end of the bellcrank pivot need a touch of Loctite to keep them secure. The rear end of the rod acts as a stop against the cab front and should be trimmed such that the operating levers are kept

about 1/16" clear of the front wheels. It is necessary to cut a small slot in the front of the cab to allow the rear piece of operating pushrod through, and this can be marked out and cut to suit the rod. I don't think it worth adding to the laser cutting job as then the rod bends would have to be made exactly right, whereas cutting to suit gives more freedom.

Photograph 170 shows the assembled rods and levers under the cylinders. Here, too, a drop of Loctite in the right places will secure things.

THE FINALE

At this stage I had loose fitted tanks and cab and bags of bits and pieces, pipes and fittings and trays of fasteners all needing to be finally assembled. Under my usual process I would have

dismantled all the fully assembled parts and painted them before final reassembly. This time, to prove it worked before sending this series to our editor I finished the assembly unpainted. This is my order of play:

First there was the insulation to add to the tanks, **photo 171**, shows the 1/4" soft stuff from Blackgates, held in place with a spray adhesive. This compressed down easily where space is tighter around the smokebox. The tanks were then bolted in place and the top cross beams fitted, followed by the cab and the brake handle. The handrail went on next and one of those small hex 8BA nuts was useful for the front stanchion as clearance is tight, but even so it was a fiddle to get on. The petticoat, chimney and dome then went on, followed by the top covers. After all the care putting



Photo 171: Insulation for between the pannier tanks and the boiler.

the holes through for the covers then these should have fitted easily, but life is not like that. The tanks are bolted down tighter now than before so of course some of the holes no longer aligned accurately with those in the tanks. The solution was simply to put larger clearance holes into the covers. Under the covers there needs to be more insulation, and the pair around the dome need just the minimum of bolts for now as they'll be coming off for the boiler testing. Here the wisdom of the prototype's modification putting the dome and chimney on top of the covers becomes evident.

The boiler backhead cover and firebox door came next, Boiler fittings were put in, remembering to seal all the threads in the boiler bushes. For the spindle glands I separated out the strands from some graphited yarn to be wrapped around each spindle before putting the gland nuts on. This provides a good low friction seal. For gauge glass sealing I use slices of the rubber tube sold for the purpose, but O-rings are an option. Finally there's the water pipework and whistle; just more of the same. **Photograph 172** shows a little gadget that is made from brass tube and just clips around the water gauge gland nuts behind the glass to make the level more visible on a sunny day when the backhead is (eventually) painted black

With the engine now ready to go, and if a reliable pressure gauge is available or the one for the model has already been tested, then the boiler and tanks can be filled and the pressure pumped up using the hand pump. Inevitably there will be dribbles of water to attend to and it's better to do this now than waste time on the formal test day. When all is well it's hard to resist putting blocks under the buffer beams to lift the wheels clear and steaming-up (this is not recommended for novices).

Test day at the track went as well as could be expected for a new design. The boiler passed, and a mile or so run

but with some stops for blow-ups. It was rather too frantic for pictures, but next time out a couple were taken: On the steaming bay, **photo 173**, and ready to go on the track, **photo 174**. You can see I spent some money on a pair of Diane Carney GWR number plates. Lovely job. Since the first run, I'd opened out the slots in the grate to allow more air through and the stops for blow-ups didn't hold anyone else up more than they held me up. For the third outing I reduced the blast nozzle from 9/64" to 1/8" diameter, and as mentioned previously this is close to Martin Evans recommendations for cylinders of the size on this model. I was now able to complete circuits non-stop. Before anyone says 'big deal' I must tell you that my club's track is a full half mile round and has long pull up to a maximum gradient of 1 in 53 before crossing over itself via a bridge and descending again to the station. A proper drivers track, one could say. The engine has ample power and good traction for its size, and is free running. Firing needs to be

little and often, and at the station after that half mile it will need a good rake through. The crosshead water pump is just nicely sized with a little flow going to bypass while maintaining the water level, but I must say that having soft solder in the boiler makes one pay very careful attention to it. Oil usage is just right; damp chimney, clean hair, and enough in the tank for a couple of miles or more. So, in conclusion I'll say that it meets my aim of having a small, attractive and easily portable engine which will give a bit of entertainment for not much effort on the day.

And finally, a heartfelt thank you to all our specialist suppliers who provided the bits and pieces and materials for this project. All, and I used most of them, provided a good service. In general I've been keeping the project secret so most did not know what they were supplying things for, but special mention must be given to Model Engineers Laser who provided all the laser cut flat parts, and to Blackgates for finding that perfect dome casting. Our hobby is truly fortunate to have them all. 🍷

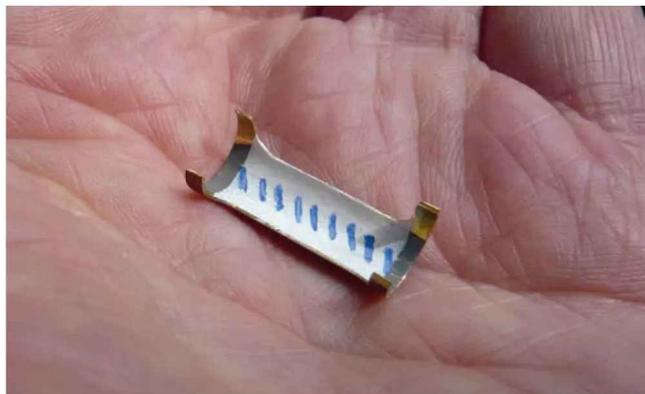


Photo 172: Level marker for the gauge glass.



Photo 174: Out on the track at last, lovely number plates there!

01526 328772

STATION ROAD STEAM

LOCOMOTIVE BUILDERS • BOILERMAKERS

Engines of all sizes bought & sold

Good prices paid up front - no waiting, no commission!

For full details, high resolution pictures and video go to our website

www.stationroadsteam.com

Visitors welcome by appointment

Unit 16-17 Moorlands Trading Estate,

Metheringham, Lincs LN4 3HX

info@stationroadsteam.com

01526 328772

CRAFTMASTER
PAINTS

01954 231308

www.craftmasterpaints.co.uk

info@craftmasterpaints.co.uk

The UK's Leading Heritage Paint Supplier

We provide traditional brushing Coach Enamels for a wide range of applications including Steam Engines, Locomotives and Classic Cars. Alongside this we provide Engine Enamel for Stationary Engines and Machinery in original colours.

Please visit our website for further information or get in touch for a free Standard Colour Range colour chart





Laurie Leonard



Photo 4: Granite surface plate

A Housing for a Granite Surface Plate

A reliable flat surface is essential for many marking out and assembly tasks, Laurie Leonard discusses how he protects and stores his.

Marking out is a frequent activity in metalworking and the outcome of most jobs is dependent on how well this activity is performed. For many years I have used a piece of gauge plate to act as the surface plate. In fact, I had two similar off cuts, **photo 1**, that I acquired on advice from one of the foremen where I worked. These are rather small, approximately 9" x 6",

and in time I purchased a second hand 18" x 12" cast iron surface plate. This had seen better days, evident before purchase, but was scraped to greatly improve the surface. It was nice and large and worked well but had a couple of major drawbacks: it was large and heavy. As the years rolled by and I had a back operation I concluded that it was too heavy and had to go, so back to the gauge plate. One day I noticed



Photo 1: Offcuts of gauge plate used as a surface plate



Photo 2: Gauging the warp in the gauge plates



Photo 3: Using the gauge plates to plain (level) a page of type



Photo 5: Completed surface plate transportation tray with protective lid

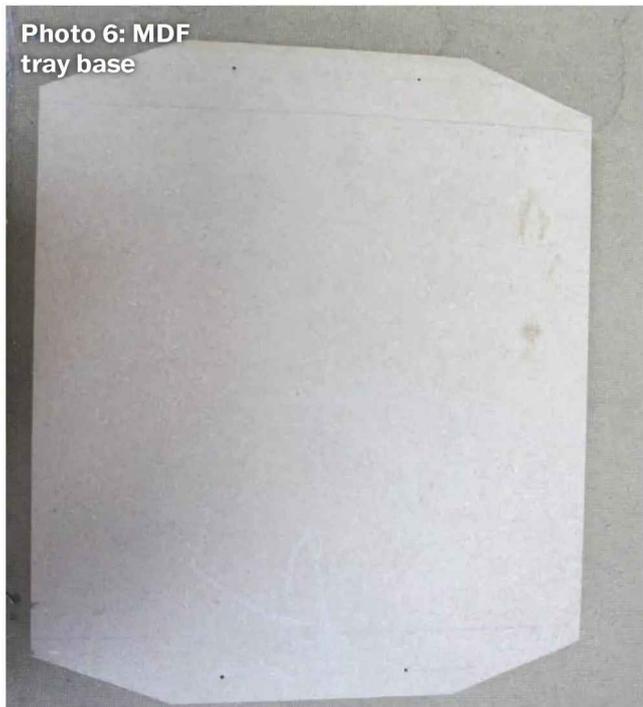


Photo 6: MDF tray base

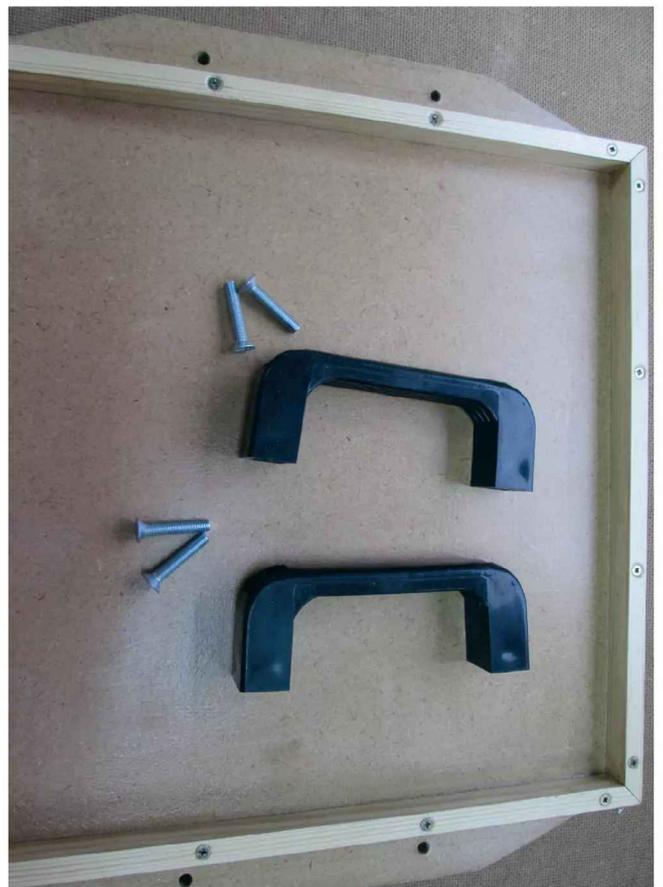


Photo 7: Tray with lip and found handles



Photo 8: Drilling the hole to take the handle screw retaining nut

that with one plate sitting above the other they rocked: one or both were not flat. To get a measure of the problem I inserted feelers in the open corner gap, **photo 2**, and was able to get a 25 thou feeler in. Further investigation showed it was basically one plate that was warped. This was detectable carrying out a straight edge check and moving a zeroed digital height gauge around the plate and grounding it at various places.

These plates have also been used as a flat surface for planning and knocking down level, a page of composed type ready for printing via the letterpress method, **photo 3**. This is another hobby of mine. I have an Adana letterpress



Photo 9 & 10: Drawing the nut into the hole in the base

printing machine, and I suspect that this name will be familiar to many readers from their adverts. I do not recall ever doubting that the planed surface was flat, but the printing press is adjusted for each job to get a quality impression.

Although one plate was deemed to be operationa,l something better was called for. Granite surface plates are available and, having investigated these, I concluded that I could handle one about a foot square. One was purchased, **photo 4**.

PROTECTION AND HANDLING

There is no denying that a foot square lump of granite is heavy and so I had already allocated the corner of one of my benches as a storage area for it to reduce handling. This raised the question of protection as it was effectively permanently 'out'. It was decided to make a tray, to assist movement, with a protective lid shown completed in **photo 5**.

CONSTRUCTION

These notes are given bearing in mind that individuals have their own requirements and my tray/cover was made from materials to hand (the virus makes you think twice about shopping particularly when you have reached a certain age).

The base was cut from a piece of 18mm Medium Density Fibreboard (MDF). I am not a fan of this material preferring good old plywood but it was to hand and was deemed to be strong enough for job, **photo 6**. A lip to retain the plate was made from strip softwood and was glued and screwed to the base, **photo 7**, and two substantial handles were located in the 'may be useful' box. I anticipated that the handles would be used to move and carry the surface plate as it is difficult to handle, so it was important that they were firmly attached. Accordingly screws and nuts were used to fasten them to the tray base. One advantage of MDF is that there is give in it. A hole the depth of the nut and diameter about the cross flats



Photo 11, 12, 13 & 14: Stages in the construction of the protective lid



Photo 15: Protective lid with polystyrene shock absorber

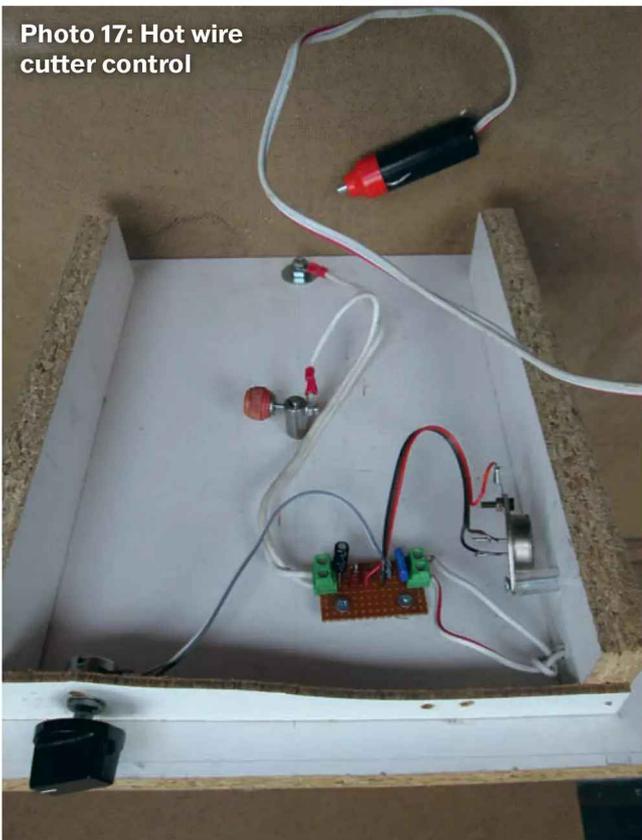


Photo 17: Hot wire cutter control

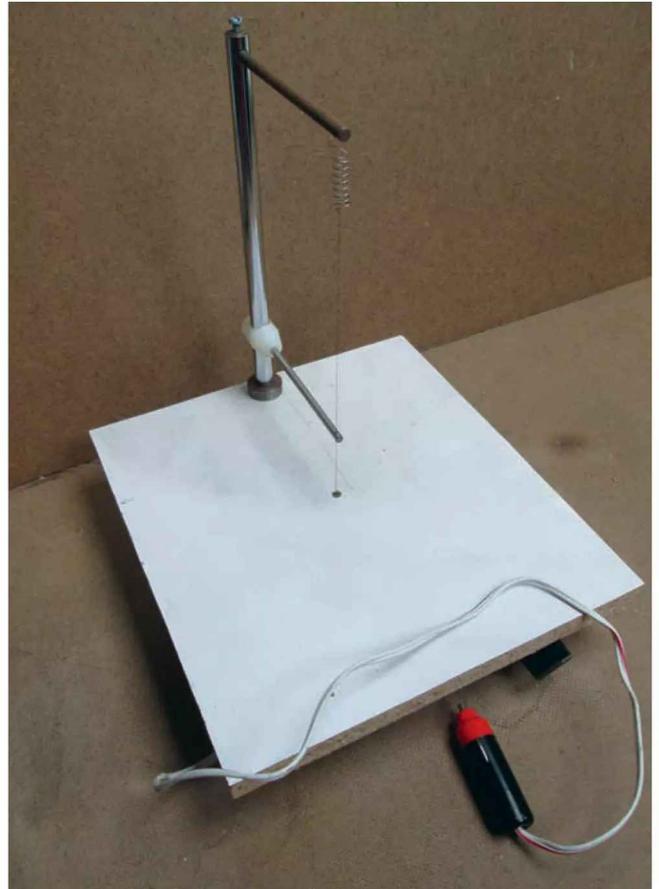


Photo 16: Hot wire cutter



Photo 19: Potential mobility castors



Photo 18: Completed job in use

size of the nut to be used was drilled, **photo 8**, and the nut drawn into it by a bolt on the other side, **photos 9** and **10**.

The 9mm plywood sides and 3mm plywood top of the protective lid are shown in **photo 11**, with dowel fixing holes drilled, **photo 12** and dry test assembly in **photo 13** with the final glue up shown in **photo 14**. I would have liked a much thicker top but did not have any 6mm ply so opted to provide an internal polystyrene shock absorber, **photo 15**.

I intended to use my hot wire polystyrene cutter, **photo 16**. This was made using information from the article in *Model Engineers Workshop* issues 184 - 185, **ref. 1**. My version has a variable voltage supply, derived from a 12-volt battery with a variable voltage regulator circuit, **photo 17** and was obviously lashed up quickly for a job. Using the hot wire cutter gives a very neat edge (a saw really makes a mess and you end up with polystyrene balls stuck to you and the saw). The throat on my version was not big enough to take the sheet I had to hand, but I found that the piece I had cut quite well by scoring it with a knife and snapping it along the cut.

The completed job in use is shown in **photo 18**. Still very conscious of the weight I thought about putting castors on the bottom, **photo 19**, to move it around the bench but concluded it did not need it with the control afforded by the handles. I find it hard to sight the scoring edge of the digital height gauge when it is in use on the surface plate resting on the bench and end up crouching down. As the handles on the tray make the surface plate moveable, I have thought of placing it on the drill press table and cranking this to a suitable working height, **photos 20** and **21**, but not yet tried this in anger. It should be noted that my drill press model has a rack and pinion height adjustment. There is no hiding the ambience of my shed!

CONCLUSION

A satisfactory conclusion to the job and fortunately the handles earmarked for the job did not poke above the surface of the surface plate to interfere with the job in hand!

REFERENCE

1 MEW 184 & 5. Mike Cox, "A Hot Wire Cutter for Expanded Polystyrene"



Photo 20&21 Utilising a drill press table to enable working height adjustment

Alibre Atom 3D 6 Month Trial Offer



To introduce readers to 3D CAD, Alibre have partnered with Model Engineer & Workshop to provide a six-month free license of Alibre Atom 3D for readers.

To claim the six-month license, please go to <https://www.alibre.com/get-a-trial-of-alibre-atom3d/> and fill in the form to request a download link.



Once you have downloaded and installed the software, fill in your details on the Welcome page and click NEXT.

On the next screen, click on the 'Enter Partner Code' radio button, then enter the code MEW, and click NEXT.

This will activate the software for six months.

Please note if you have had a trial of Alibre in the past, the partner code will not work. If this is the case, please contact Alibre at the following email address to request a temporary license key: hello@alibre.com.

How to Access Free Video Guides and Alibre Atom 3D Training Course:

If you would like a more detailed guide to creating the parts, assembly and drawing covered in this article, we have full step by step video guides on our YouTube channel at <https://www.youtube.com/@RF3DESIGN>



If you would like further guidance RF3 Design offers an in depth Alibre Atom 3D training course with guide videos and step by step written instructions at: <https://www.rf3dtraining.com/atom3d101>



Please use code MEW2026 at the checkout for an exclusive 50% discount for MEW readers.



Be a part of making things possible

REMAP is a charity which connects volunteer inventors with local people with disabilities to help them achieve greater independence and enjoyment of life's opportunities.

We have over 60 volunteer-led branches that support their local communities throughout England, Scotland and Wales.



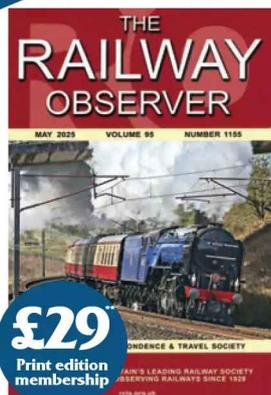
Find out more www.remap.org.uk

Charity no: 1137666 | Scotland: SC050584

VISITS • BOOKS • DIGITAL ARCHIVE • LOCO DATABASE

Join Britain's Leading Railway Society

Just £10 for membership until December 2026*



Membership benefits include:

- Discounts on many of the Society's books
- Exclusive visit programme to railway facilities and heritage sites
- Talks and illustrated presentations at branches throughout the UK
- Discounted access to the Modern Traction locomotive database
- Extensive library and archive, plus...

The Railway Observer (digital edition) – A monthly 72 page full colour magazine, featuring:

- Superb quality pictures
- Network operating reports
- Loco and unit stock changes
- Infrastructure news
- Articles on a range of railway subjects and much more...

www.rcts.org.uk/join

*Offer available until 30 April. Applies to new members, with digital magazine: Terms and conditions apply - Total annual fee - £10
** Offer available until 30 April. Applies to new members, with printed magazine: Terms and conditions apply - Total annual fee - £29
RCTS is a charitable incorporated organisation, registered with the Charity Commission for England and Wales. Registered Number 1169995

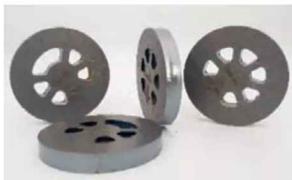




**MODEL ENGINEERS
LASER**

07927 087 172
modelengineerslaser.co.uk
sales@modelengineerslaser.co.uk

No minimum order for custom cutting in laser, water and plasma in steel, stainless, brass, plywood, plastics, copper, bronze, gauge plate, aluminium.



Over 41600 parts for many common designs such as:

- Britannia
- Evening Star
- Doris
- Galatea
- Pansy
- Simplex
- Torquay Manor
- Lilla
- Rob Roy
- Lion
- Holmside



J A Alcock & Son Courses



Craft Your Own Mechanical Clock Movement

Introduction to Practical Clock Servicing

3 East Workshops, Harley Foundation Studios,
Welbeck, Worksop, S80 3LW
(Workshop visits by appointment only)

For more information including additional courses run by J A Alcock & Son
please see our website

Tel: 01909 488 866 Web: www.sortyourclock.co.uk

All courses taught by a Fellow of the British Horological Institute

Find us on [@sortyourclock](https://www.facebook.com/sortyourclock)



THE
HARLEY
FOUNDATION

HOME AND WORKSHOP MACHINERY



Lorch LAS lathe £4250

144 Maidstone Road, Fooks Cray, Sidcup, Kent, DA14 5HS
Tel: 020 8300 9070 - evenings 01959 532199
website: www.homeandworkshop.co.uk
email: sales@homeandworkshop.co.uk
visit our eBay store! almost 8000 items available; link on website;
homeandworkshopmachinery



Harrison M300 £3500



Colchester Triumph 2000 lathe £6250

Colchester Banlam 2000 lathe (long bed)
metric leadscrew, Dickson post £3250



Emco Super 11 head £1450



Boxford AUD Mk111 5" x 22", rare
Griptru 3 jaw, DRO + inverter £3750



Harrison L5,
M250, M300
Colchester
Student
1200 / 1800 +
A&S 1ES
gears



Super 7 lathe
'very nice example!' £3450



JET GH1440 lathe from art college in
very good order complete £3450
NICE!



Myford Super 7B Connoisseur centre
lathe + Tesla inverter, DRO, stand, tooling
£9750 Stunning!



Myford 254 PLUS IMP 240V 'very
nice' with rare D-13 head £7250

Please phone 0208 300 9070 to check availability.
Distance no problem – Pallets leaving daily! – prices exclusive of VAT
Just a small selection of our current stock photographed!



Colchester steady!

Worldwide
Shipping



Photo 11: The finished tram.



PART 2 A Solar Powered Tram

Martin Reed concludes his description of an unconventional project.

The electrical control system is shown in **fig. 1**. It was necessary to include a fallback in case of the solar panel array being unable to provide sufficient power, e.g. passing under an occulting footbridge. This was provided by two rechargeable PP3 batteries, the voltage of which is normally one diode drop less than the solar panel output voltage, thus in ideal operating conditions, the solar array will provide the necessary current by way of the diode D2. When the solar voltage falls significantly below that of the battery, current is supplied by way of D1 from the battery.

SW1 is a DPDT switch, that connects the batteries to the drive circuit. When the switch is in the opposite position, the battery connection is to an external charging system.

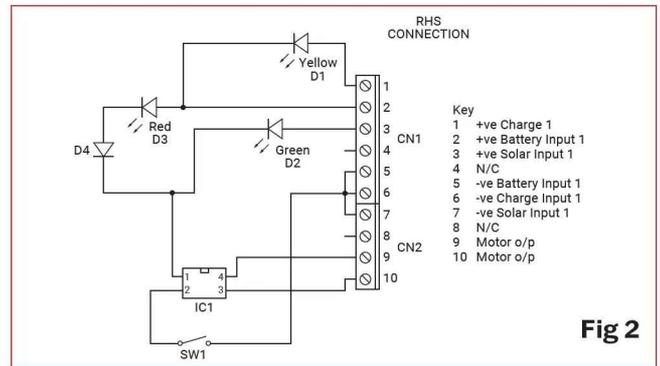
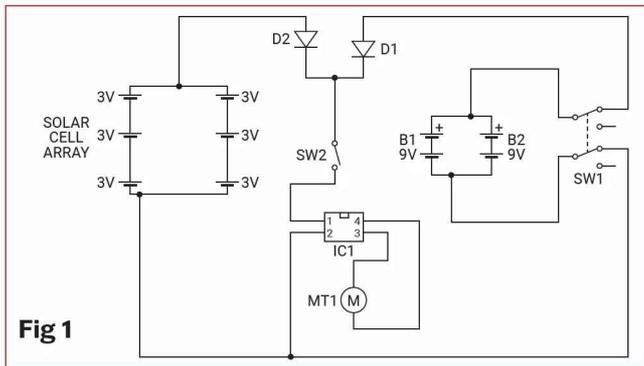
IC1 is an adjustable voltage regulator supplied by the 'The Component Shop' which will maintain the required motor drive voltage down to a supply voltage of about 4.5v. With SW2 closed the motor will run.

The components needed were mounted on raised Veroboard above the level of the central baseplate. This allowed for access of the switches through the windows on the body.

The batteries were mounted on the baseplate itself. **Photograph 9** shows the completed assembly ready to re-attach.

The green LED indicates battery power, unlit when solar is in command. It is hoped later revisions of the cab will include a horn and lights, so room is left available.

You may observe two voltage regulators are present on the board. This was because of a significant difference in speed between the motors powered by just one regulator, so the chosen solution was to fit two and tune each regulator individually



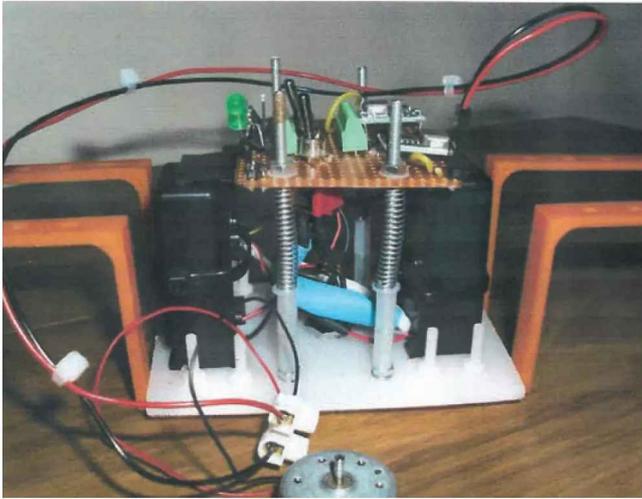


Photo 9: Original electrical system.

to provide a synchronised speed (hopefully).

After seven months, the tram made its first outing on the local model engineer garden gauge track one chilly June Sunday morning. Thankfully only one other club member was present, the monthly magazine editor. Despite my offer to buy his silence he threatened in true journalistic tabloid style, to 'tell all' so I have no option but to come clean!

Although one bogie ran quite well the other one moved as if it had been designed along the wibbly-wobbly way. The use of a DTI has been prescribed by the club clinician.

With energy conservation paramount, it seemed appropriate that when coming to redesign that unsatisfactory cab section, an attempt at an 'aerodynamically efficient' looking structure seemed appropriate. Or thereabouts! Hence the first go at modelling curved surfaces.

The basic concept is a half cone shown on the left in **photo 10**. The important thing about this is that, provided the gradient is steep enough, the half cone can be printed with no support, a big advantage.

It was then just a matter of pushing and pulling the drawing with the 'scale' tool of Sketchup to an elliptical profile (I've always been an eccentric), then punching a hole through for the window and attaching the whole to a back-plate. The first draft of the cab is shown alongside at right. All that remains is to add in the lamp-holders.

The finished item is segmented, as you may be able to observe. The Sketchup program defaults to 24 segments per circumference but any number can be chosen depending on the radius size. I chose to stay with the default for now and I am not too dissatisfied with the appearance.

It was a very anxious moment as the first test print approached completion. I opted to go for an unsupported structure. Would it hold up? Just to be clear, I should explain about support. If you tried to print an inverted letter 'L' the upright post would be fine, but the limb has nothing but thin air underneath it and the fluid filament would just drop onto the bed.

The printer is smart enough to realise this and the 'slicer' program offers to support the limb by laying down a loose matrix directly beneath it, which rises up progressively with the upright section. In the case of a printer with two nozzles the support matrix can be of dissimilar material that makes it easier to break away at the end of the print.

The trouble is, as I said in part 1, it considerably lengthens the print time and if you are not careful your entire life can revolve around the operation. (Not tonight Josephine, I have to keep checking on the print).

With the problem of plastic in the waste stream now being given the attention it deserves, it I might be worth considering materials in question. The usual materials for 3D printing are ABS (acrylonitrile butadiene styrene) and PLA. ABS polymer is recyclable where the infrastructure is in place. PLA is likewise recyclable in theory however being very different to all other common polymers, (it's plant not oil based) its presence can contaminate the recovery process.

PLA is poly lactic acid, lactic acid being what makes milk sour and causes stiff muscles. You might then be forgiven for assuming (as I did) that PLA is biodegradable. So, I consult the Internet. Sadly it seems, the short answer is no. The polymer is a form of lactic acid that does not exist in nature and consequently very few

micro-organisms have evolved the right enzymes to break it down, and even then, there needs to be chemical processing before bio-digestion. (PLA can be composted in high-temperature industrial digesters – contact your local Council for how best to dispose of it – Ed.)

For a variety of reasons, I decided on a change to the electrical system. Now each bogie is fed by an isolated separate circuit. **Figure 2** illustrates the connections on the RHS (1). LHS(2) is an identical arrangement (not shown). Also not shown is the battery charge selector switch. IC1 is the voltage regulator as described in part 1. Diode D3 is there to ensure a large enough differential. The lights are powered by a 9v battery housed in one of the cabs. Not very imaginative really.

The finished item is shown in **Photo 11**. Somewhat incongruous surely? Futuristic front end, sides and roof, relics of WWI. As the man said when challenged by his landlord about keeping bees in his bedroom 'well it's only a hobby...'

I don't have any pretensions about this, it's a prototype but I do hope it illustrates the versatility and potential of 3D printing as a constructional tool usable with only the minimum of skill and gives encouragement to others to acquaint themselves with this terrific 21st century device.

As to the aerodynamic properties, the wind tunnel tests were not quite what I expected. I think it must have been that cabbage!

Thanks to Lee Bowman at CEL Robox for his technical support, Phil Tranter at Xchange training for the excellent Sketchup instruction and lastly to Grimsby & Cleethorpes Model Engineering Society for providing a first-rate running track. ●



Photo 10: New front section.

These articles by Geometer (Ian Bradley) were written about seventy years 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 practiced in the past.

Beginner's Workshop

TESTING LATHE ACCURACY

THE most important test of a lathe lies, no doubt, in the accuracy of the work and the manner in which it is produced—a skilled operator being able to overcome considerable basic inaccuracy. Even if the work is of a relatively simple character, ample scope for error exists—provided there is sufficient variation to test all aspects of alignment.

This is to say, a lathe may be accurate for one type of work but not for another, and experience of it can indicate where to expect errors, though the reason why may not always be immediately apparent. However, there are various simple tests which are largely a substitute for “work experience” and which can be useful for discovering errors, for truing the machine (if possible), or on occasion for setting up.

A simple but important test, *A*, is the meeting of headstock and tailstock centres. When the fixed centre has noticeably dropped, wear of the underside of the tailstock and possibly of the bed itself is indicated. The effect on between-centre turning may be small or non-existent, but care will be necessary when using centre drills or boring cutters from the tailstock—a degree of “lift” then being necessary for the tools to centre.

The same effect also obtains when supporting chucked work from the tailstock. This test should be made with the barrel both close in and well extended. A sideways error of the same kind can often be corrected by adjusting the tailstock.

A more severe test of the same sort, *B*, can be made with an indicator, which can be a dial type or one of the small inexpensive varieties. The indicator is mounted in a chuck or on

a driving plate with its plunger bearing on the fixed centre. Then the machine spindle is turned, when a steady reading shows perfect alignment, using a small mirror to see the instrument upside down and from behind.

Where there are variations in readings, as is virtually always the case, it can be seen in which direction (vertically or sideways) they occur, and the tailstock adjusted to correct sideways error.

A live centre test for running truth, *B*, can be made of the one normally in the spindle and of others of the same taper with the indicator mounted on the slide-rest. This can sometimes reveal that the centres themselves have not been ground true; and in use it may be advisable to keep them to one position—spindle or tailstock—marking for fitting in a certain manner.

GENERAL ALIGNMENT

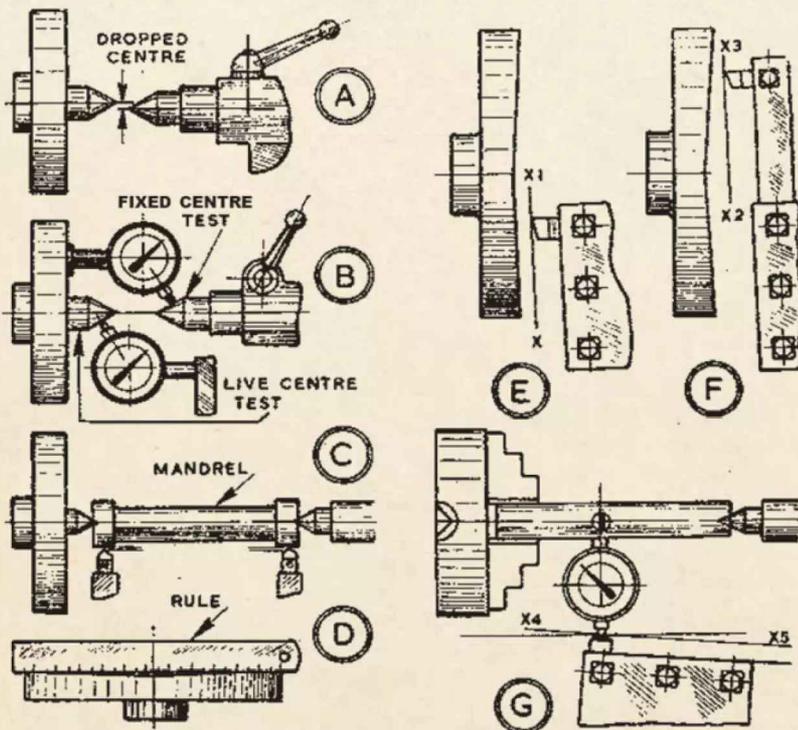
A test for general alignment of headstock and tailstock for between-centre turning can be made employing a mandrel, *C*. Any suitable piece of rod can be used, carefully centred, reduced in its length, and with the ends turned the same size.

A tool mounted on the slide-rest can be brought close to one diameter, leaving a small gap, then the gap checked on the other diameter, a piece of white paper on the bed providing a light background against which to see the gaps. Finally, the tool may be set to touch the diameters lightly when traversing the saddle. This aids reasonable setting of a lathe before work begins, and as an alternative to a tool an indicator can be used.

A faceplate may be checked with a rule, *D*, and when mounted on the spindle and rotated is tested for face wobble. If chuck work is machined true, a test can be made on the faceplate of cross-slide alignment in two stages, *E* and *F*, using a tool or an indicator.

Testing along the near side along line X-X1, no error may be shown if the faceplate was machined on the lathe, for alignment corresponds to the cross-slide. Testing on the far side, however, on line X2-X3, any error is doubled and can be easily seen.

Topslide setting can be tested as *G*, an indicator on a mandrel and a rounded rod on the slide-rest. With the slide out of alignment, movement is along such as X4-X5, and checking with saddle traverse, variations are shown, whereas with a true setting readings will be all the same.





Club News

Geoff Theasby reports on the latest news from Model Engineering Clubs.



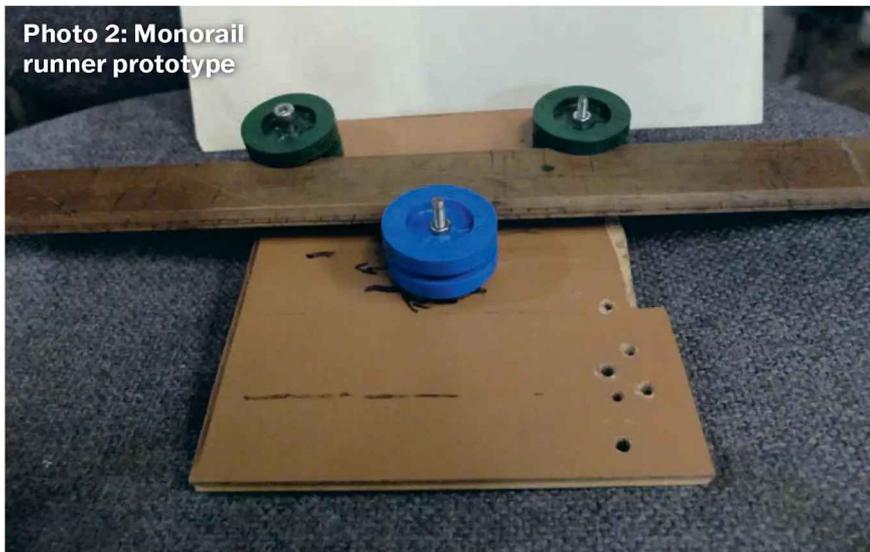
Photo 1: Andre Chapelon locomotive

I'm having trouble with my email, as Google has upgraded my regular home page and I am totally confused. Several subcategories have been opened without my consent, and my messages have seemingly been distributed at random between them. Consequently I am not sure if I have seen all the messages intended for me. I think I have discovered how to modify the requirements for incoming posts. Watch this space. A new missive arrives from another Sheffield Club. I'm not sure any of the similar local clubs have produced a newsletter before, so good work David, from the finest Newsletter Editor in Firth Park. It's not an engineering club, but Amateur Radio, (but you know I have a soft spot for that subject). I see from the Daily Telegraph that Roland Paxton has died. He personally restored the world's oldest railway bridge, and campaigned for the upkeep of the Forth Bridge, which was in danger of being neglected. He is also notable for disputing the local myth that a horse and cart were buried in one of the concrete columns of Glenfinnan viaduct. He did, however, prove that such an occurrence did occur at Loch nam Uanh Viaduct not far away. He used radar to examine the interiors of the 9 ft thick columns, and there it was, the horse, together with the wreck of a cart. W.

www.moidart.org.uk/justoutside/horseinviaduct/horseinviaduct.htm In this issue, a rebuilt brake van, an obscure font, a rebuilt tram, a monorail, and steam ploughing. **The Gauge 3 Society** autumn Newsletter arrives, closely followed by the winter edition. Ian Harper wrote on the exhibition at Darlington, for the AGM of the Gauge 1 Society. Ian also wrote up the Gauge 3 presence at Bakewell. This was unexpected, as it is a Gauge 1 event. However, the electrically-powered radio-controlled Kippo Models Class 47 from exhibition manager John Saunders raised much interest. Jon Nazareth built an early horsebox (see last month). Tim Gleed-Owen made a raised concrete trackbed on his garden layout. Ralph Brades' Kingscale A4 *Mallard* in Garter Blue, shows its cab controls as well as a picture taken at Eddie Williams' GTG in the summer. John Tucket made a new layout based upon St. Pancras goods yard. The Winter issue welcomes new members, who are greeted by a model *Tornado* on the running plate of the full-size version. Stewart Jones was inspired to start a new project after discovering a LSWR goods van to diagram 1409 hidden in undergrowth. Fortunately, there are many kits on the market offering similar G3 models. The metalwork of this decrepit vehicle appears complete including a horse hook (qv). There are a

couple of buckets of water, conveniently to hand, for fighting fires and filling boilers. W. www.gauge3.org.uk The *Gauge 1 Newsletter and Journal* for the **Gauge 1 Model Railway Association** for December arrives, bearing on the front cover a close-up of the backhead of an unidentified locomotive at a Swiss event, showing that the fire is burning nicely, there is water in the glass and the steam pressure at mid-scale, and calibrated (but not red-lines) in HectoPascals (milli-bars to you, Sir). Editor, Rod Clarke came to the UK, firstly visiting Scarborough, which reminded him of a family holiday there in 1949, and visiting the North Bay Railway; then the Darlington for the Gauge 1 AGM and show at Hopetown. Secretary Adam Barr notes that during his travels he found that mainland Europe is the base for commercial makers of models, and not the UK as we might surmise. The show itself is reported by Stuart Hithersay, who is pictured next to a newly restored 0-4-0 ST, which I should be able to identify, but failed. David Halfpenny reviewed the AGM and also reminded members to send their contributions to the incoming new editor, for, as we know, Rod Clarke is retiring from his post as editor. Oliver Trocherle reviews a French GTG, at which was a magnificent Aster 24P from Spain, and a Samhongsu UPRR.

Photo 2: Monorail runner prototype



The Samhonsa Company is new to me, but they have been making model locomotives since the 1970s. Yves Eittener noted the change to mainly electric locomotives in Europe together with digital control. This has not changed the popularity of live steam. Geoff Hallam built a tram, by way of a change, and decided on a Boon tram from Christchurch, NZ. There is one survivor in the class which was restored from a rotting hulk after being withdrawn in 1952. Geoff noted the unusual font on the tram lettering, but does not say what it is. Fortunately, there are those who know more than I do, and suggest that it is *Trade Gothic next soft rounded heavy compressed*. David Viewing and Donald Pocket write on making a 3-D of *Active*, later known as *Locomotion No 1*. Simon Duhamel describes the coke wagon on the Nord Railway, bound for the steelmaking furnaces of Lorraine. John Horner tells his Gauge 1 history, starting with the GWR 'County' made by Alan Curtis. Chris Ludlow tells of a marvellous model of a marvellous prototype, in the form of an Aster Chapelon 'Pacific'. They were first introduced on the Paris-Lyon in 1908. Good, but not much of an advance on their outmoded sisters. The Chief Engineer Andre Chapelon was given the task of improving them. His design improvements were such that he could nearly double the power out, and people began to take notice. The Chemin de Fer du Nord ordered twenty to be rebuilt, and later, twenty-eight originals. It is interesting to note that Andre Chapelon never built a new engine, all his formidable reputation is built on rebuilding engines. The SNCF once obtained a speed of 108 mph on a test train. A photo shows their incredibly fussy appearance hung about as it is with piping, control equipment, various

domes etc, there is scarcely a space of plain boiler cladding to be seen, **photo 1**. Reverting to the mundane, Tref Willingham makes a 3-D printed BR standard 20-Ton brake van, from a design first aired in 1950. The design work of converting to G1 dimensions took 75 hours at the computer, but that excludes anything 'additional', so including a basic 'box', artwork preparation, and testing, would amount to £5,000 - £7,500, amounting to about 75 calendar days. In monetary terms, a cash expenditure of less than £25 included paint and wheels. 131 individual parts, the basic structure being of only 25 parts. Ken Toone wrote of a Gauge 1 Cass 86 Inter-City express locomotive, and its train of BR Mk 2 coaches.

Michael Harris' book, *BR Mk 2 coaches* contains all the detail necessary. A really rare model, genuinely so on the Big Railway, and was a model of *Test Coach Iris*, as preserved on the Ecclesbourne Railway. There is a book on the Derby Test Centre, including this vehicle, which began life as Derby Lightweight DMU in 1956. Another rare vehicle is the *Ozark Velocipede*, available as a kit, says John Robinson. It is nominally over-scale but discreetly placed in a display or as part of the lineside furniture it could play its part. Henk Wierenga discusses his alcohol problems. Not involving his personal health, but to his locomotives. Poor steam raising capacity is often caused by excess air at the wicks. Too cold and not much steam is generated, and the fuel consumption is high. Experiments with his Aster BR01 and BR62 as well as 'Reno', belonging to a friend, showed this to be a major cause. W. www.g1mra.com The Firth Park Monorail. Having a part-completed locomotive in my garage, what better to do than start a new project to distract myself? It began over Christmas when I conceived the idea of a monorail in my basement workshop, and how it may be achieved. It could be used for transporting heavy items, including myself, for when I was not too well, and help me keep up with my radio activities and keep in contact with my fellow radio amateurs. At this point, Deborah expressed doubt, since my efforts to date have been lightweight, not to say flimsy. Sometime after beginning the project I found a similar model by an

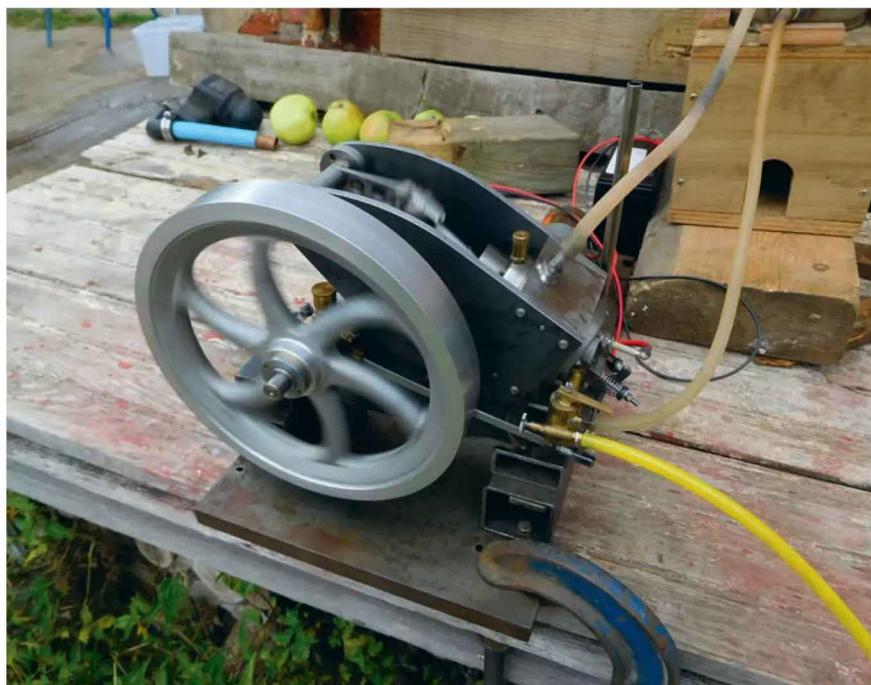


Photo 3: Hit & Miss engine courtesy of Nigel Bennett,4817.

Amateur radio

**How to...
Build a radio**

Mensa member **Geoff Theasby** shares his passion for amateur radio – and his tips for anyone interested in getting involved

One of the many aspects of achieving domestic harmony is always knowing where your partner is. In the world of amateur radio, this translates to 'not down the pub, consorting with unsuitable people or standing in a cold and windy field in support of some team activity or other'. No, he/she is in the basement/loft/shed and not sprawled in front of the television, getting underfoot. Knowledge about amateur radio among the general UK public is lacking, which is odd because in other countries it is widely understood, and so are the services that users provide. For instance, did you know that, here in the UK, there is a network of stations willing to assist with communications, supporting the civil powers – something that began after the east coast floods of 1953.

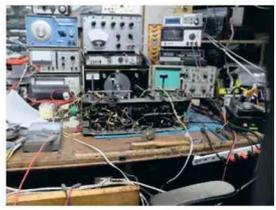
Amateur radio has been a distinct occupation for more than 100 years, through the interwar period, when it was widely popular. Then later, Citizens Band (CB) in the 1970s created a greater knowledge of radio communication. Covid-19 restrictions then had little effect on many of us as we retired to our separate basements/lofts/sheds for the duration, chatting to fellow enthusiasts via radio.

‘YOU CAN MAKE A TINY TRANSMITTER OR RECEIVER FOR JUST £1’

HOW TO BEGIN?
Join a club! Radio amateurs by the very nature of their choice of activity tend to be solitary people, yet there is immense benefit to the tyro in being able to discuss technical problems with more experienced practitioners. Subscribe to a magazine – much can be learned from the discussions and articles within. The Radio Society of Great Britain's house magazine, *RadCom*, is a world leader in the quality of its technical writing, plus the society represents the UK at international conferences. Back numbers of its publications can build a considerable library yet, conversely, sell for very little, if at all, on the open market. There are many aspects of this hobby – voice, television, computers, radio astronomy, etc. And, while some enthusiasts collect performance certificates in contests on the air, others prefer to make small items of ancillary equipment as the building of a radio station using



Geoff on the airwaves from his radio station



A serviceable workbench like Geoff's will be a necessity

modern techniques is becoming difficult for those outside the industry to match.

2 IT NEED NOT BE EXPENSIVE
There is a feeling by some that this is an expensive pastime, but everything is expensive if you choose to make it so. In fact, whilst you can spend thousands, you can make a tiny transmitter or receiver for just £1. Kits for simple transmitters and receivers can be bought used,

or built. I made a shortwave transmitter using a pre-built circuit board made in rural India. I built it into a cabinet, bought for £1 at a radio rally, and it worked very well.

I currently use a well-regarded Japanese transmitter, which I repaired, and find it a joy to use (a transmitter is a combined transmitter and receiver in one case). I have built power supplies, noise filters, electronic clocks and test meters. I am currently fabricating an 'impossible-to-

buy' electrical plug for a radio I repaired, which will enhance the ease of use for the operator.

3 SOLDER ON!
Learn how to solder. You'll improve with practice. When making products like the above plug, a bad joint can be hard to find, and good soldering is vital for success. There are electronic kits, costing less than £10 – LED flashers, clocks, sirens, simple transmitters, amplifiers, etc. – available via Amazon and magazines.

ARE YOU AN EXPERT?
Could you describe to a layperson how to get started in your own area of expertise? It could be anything from painting to writing computer code.
● Get in touch (editor@mensa.org.uk) and we might ask you to help us create a guide for IQ.

4 TRY IT OUT
There are many capable receivers on the used market. If you want to transmit, you must take a technical test and be certified by the UK government to be a suitable person to operate such a device safely. Get some practice by listening in first, and find out which frequency bands and modes you prefer. Try out someone else's equipment under supervision. If necessary, Aerials are fun and cheap to make. In the loft or in the garden.

If you must spend large amounts of 'wonga', there are high-grade receivers costing upwards of £10,000. However, yesterday's state-of-the-art equipment is today's 'bargain'. Although the term 'amateur' may suggest an inexperienced approach, the ranks of the senior, well-qualified people who share this hobby contain many who take their day job home with them at the end of the working day and don't become jaded by it. These roles include radio astronomy and computer software. Once, on a visit to Jodrell Bank, my friend told the lecturer that I had built a radio telescope in the garden. The speaker was most interested to meet an enthusiast, rather than those who try to bluff their way through a conversation.

5 IT'S FUN
What do we talk about? Well, the same things you talk about with your friends when you meet. With the added attraction that we have our recent activities in that field, or maybe they have contacted a rarely heard station or had a radio expedition to little-known areas of the world. Some have spoken to the International Space Station using equipment set up by local clubs in schools, as part of the STEM Initiative. It's fun!

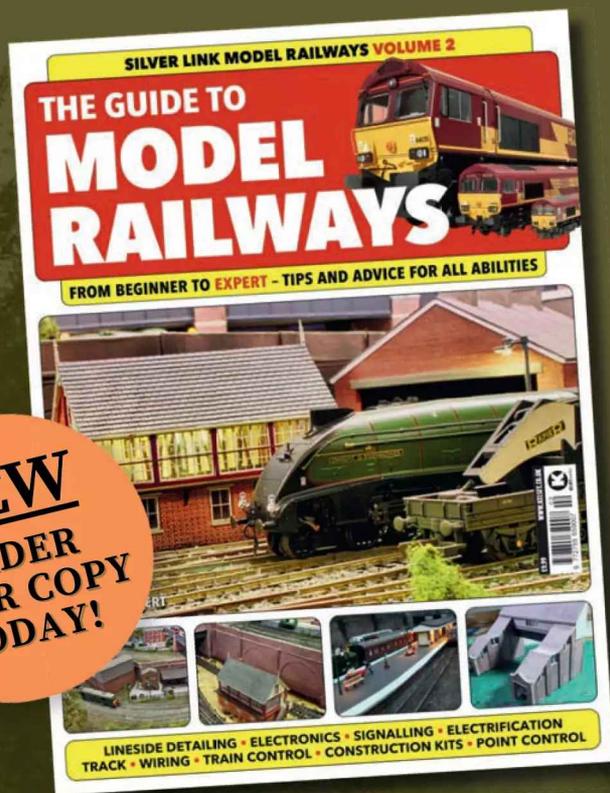
Photo 4: Fame!

Irish gentleman in YouTube, on 'Way Out West'. He used the same rail as I did, 5mm x 50mm mild steel plate, and running on the edge. No need for balancing as it will be a suspended design, and any lateral bending movement will be absorbed by the track. There is clearance at the fixing points for the passage of a vehicle. I began with the track, measuring the distance between joists in the basement, transferring them to a length of steel and then drilling holes at precisely the wrong locations. The rails are butt-joined end-to-end with flush fishplates at the joints, held together by socket grub screws within the metal, flush with the surface (so far as I am aware, this is a unique method of assembly). As with all monorails, provision of a points mechanism is difficult, so end-to-end or continuous running is usually the practice. I intend driving it by an electric motor, when I have worked out the details. I had bearings to hand, but with a large bore. Quickly made sleeves, using acrylic rod on aluminium bore, dimensions established by trial and error, a runner test is shown in **photo 2**. Nigel Bennet, *Leeds Lines newsletter editor*, for **Leeds Society of Model and Experimental Engineers**, sent

me pictures to be used as I wish in my column, **photo 3**. Thank you Nigel! Other Newsletter Editors please copy! *The Engineer*, January, celebrates its 170th Anniversary with a 'legacy issue'. Readers reflect on one of the recent magazine profiles, that of Sir Clive Sinclair, he of the first electronic calculator, pocket TV, cheap Hi-fi and that electric scooter. He was the doyen of electronics enthusiasts, often students, who appreciated the cheap prices and the potential for experimentation. I was one of them, making the Stereo 60 amplifier, and I cured the bad hum caused by routing the 240 Volt mains wiring across sensitive pre-amp circuitry. A major article covers the small modular reactor design currently being considered, and the involvement of the Advanced Manufacturing Research Centre, working with the University of Sheffield. Another considers the technology of Formula 1 and its need to be at the forefront of design in order for drivers to get the maximum out of their cars in the teeth of competition from their rivals doing the same thing in their own way. Importing the F1 ethos into industry without losing the enthusiasm or expertise of the

engineers to succeed is a particular concern. The 'other' John Fowler (i.e. not the one who designed the Forth Bridge) is also featured. Lest it be forgotten, this gentleman invented the 'two-engine' method of ploughing which relieved the soil from being crushed and compacted by the constant passage of traction engines over it. This was very useful in helping to drain the Irish bogs and improve their productivity. His company was one of several famous (each in its own way) companies in the industrial area around Hunslet in Leeds. This engineer, who, it was claimed, should be ranked with the Stephensons and Brunels, as one of history's greatest, died at the early age of 38 after a hunting accident. To round off an excellent publication, a feature on Sir Titus Salt briefly describes how he proved that industry could be both profitable and humane. W. www.theengineer.co.uk Bradford MES newsletter, the January Monthly Bulletin, transcribes Richard Pulleyn's talk on railway signalling, W. www.bradfordmes. And finally, "As you're an engineer, why are you so dumb about prototype technology?" "I don't use it, I just design it." ●

THE ULTIMATE COMPANION FOR RAILWAY MODELLERS



NEW
ORDER
YOUR COPY
TODAY!



Step-by-Step Secrets for Model Railway Success

Take your modelling skills further with **The Guide to Model Railways**. Inside Vol. 2, you'll find expert advice on baseboards, wiring, DCC, scenic detailing and electrification – plus an inspiring 365-day layout build.

Secure your copy today and start creating the layout you've always dreamed of!

ORDER YOUR COPY TODAY

VISIT shop.kelsey.co.uk/BZGMR2
CALL 01959 543 747 & QUOTE BZGMR2

SCAN ME



MODEL ENGINEER & WORKSHOP

EST. 1898

THE LEADING MAGAZINE FOR HOBBY ENGINEERS AND MODEL MAKERS

ALWAYS IN STOCK:

Huge range of miniature fixings, inc Metric, UNC, UNF, BSW, BSF & BA

Tel/Fax: +44 (0)115 854 8791 Email: info@modelfixings.com

ModelFixings.co.uk

also the home of **ModelBearings.co.uk**

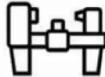
• Taps, Dies & Drills • Adhesives • Materials
• Engine & Miniature bearings • Circlips, etc. etc.

webuyanyworkshop.com

Re-homing model engineers' workshops since 2018



It's never easy selling a workshop that has been carefully established over a lifetime. I will buy your workshop so you don't have to worry about finding a new home for much loved workshop equipment & tools.



Please email photos to **andrew@webuyanyworkshop**

Alternatively WhatsApp photos to **07918 145419**

Or to discuss selling your workshop, please call Andrew on **07918 145419**

All equipment considered: Myford, Warco, Chester, classic British brands, etc

To advertise please contact Fiona Leak

Email: fiona.leak@kelsey.co.uk

Tel: 01507 529573

M-MACHINE

Unit 6 Forge Way, Cleveland Trading Estate
Darlington, Co. Durham. DL1 2PJ

Metals for Model Makers

Contact us for Copper, Brass, Aluminium, Steel, Phosphor Bronze, etc.

PHONE 01325 381300

e-mail: sales@m-machine.co.uk
www.m-machine-metals.co.uk

Complete home Workshops Purchased

Essex/Nottinghamshire locations
Distance no object!

Tel: **Mike Bidwell**

01245 222743

m: **07801 343850**

bidwells1@btconnect.com

Telephone Order or Shop Online

Order Line 0208 969 3034 www.hafixs.co.uk

Please Reference WAPR26 when placing your order

HAFIXS

Professional Glue

High Performance Glue, long shelf life, economical to use, remarkable strength, resists water, oil, grease, supports temperatures and suits most materials.

sarik hobbies

The World's Biggest Selection*

Huge range of engineering, railway & locomotive plans

MODEL ENGINEER BUILDER

O, OO & HO Gauge
Scenery, Boats & Buildings

www.sarikhobbies.com

* World's biggest selection of printed RC Model Plans & Short Kits.

Aviation Classics Monthly

The legendary aircraft of WWII to the Cold War, brought to life. Aviation Classics Monthly delivers expert features, rare archive photos and stunning commissioned art – plus an 8-page gatefold poster cover in every 88-page issue.



Subscribe today!

shop.kelsey.co.uk/aviation-classics-magazine

STEAMWAYS ENGINEERING LIMITED

LIVE STEAM LOCOMOTIVES

FROM 0 GAUGE TO 10 1/4" GAUGE



Steamways Engineering Limited builds working live steam locomotives from Gauge '0' to 10 1/4", Traction Engines up to 4" scale and stationary steam and launch engines – all to a high standard,

We also complete unfinished projects, finish paint and hand-line them.

The renovation and repair of steam models is sympathetically undertaken.

To assist you complete your own projects, we manufacture individual parts to order including supplying a range of fully certificated and EC PV Regulations compliant silver-soldered copper boilers up to and including 5 inch gauge.

Visit our Website

www.steamwaysengineering.co.uk

email us on info@steamwaysengineering.co.uk

or telephone us on **01507 206040** with your requirements for a no-obligation quote or discussion.

Steamways Engineering Limited

Dovecote House, Main Road, Maltby le Marsh, Alford, Lincs. LN13 0JP

Call: 01507 206040

5" GAUGE WAGON KITS

Email: sales@17d.uk
Phone: 01629 825070



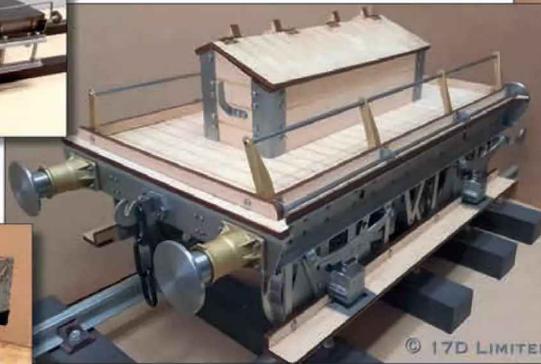
BR/LNER Brake Van
5 Plank Wagon

Kits start from around £470

See our website or call
for full details



Banana Box Van



GWR Shunters Truck

7 Plank Wagon



WHEELS

Visit www.17d-ltd.co.uk
for latest prices & stock



Machined Axle Boxes & Bearings
in 5" & 7 1/4" gauge



8 Spoke Wagon
Wheels
4 wheels / 2 axles
in 5" & 7 1/4" gauge



Bogie Kits in 5"
& 7 1/4" gauge



Plain Disc
Wheels
in 5" &
7 1/4" gauge



5" gauge 3 Hole Disc Wheels
with profiled face



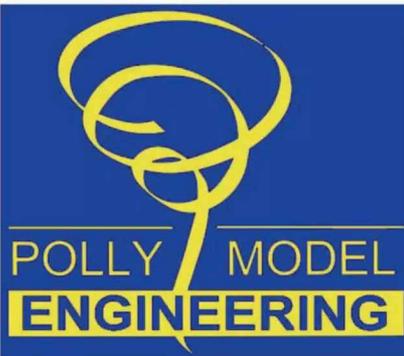
Narrow Gauge Wheels
in 5" & 7 1/4" gauge



www.17d-ltd.co.uk

MINIATURE RAILWAY SPECIALISTS
LOCOMOTIVES, ROLLING STOCK, COMPONENTS
CNC MACHINING SERVICES

17D Limited, Units 12 & 13 Via Gellia Mill, Bonsall, Matlock, Derbyshire, DE4 2AJ



POLLY MODEL ENGINEERING

*For all your Model
Engineering Requirements*



Extensive range of parts:
pressure gauges, injectors,
steam valves, superheaters,
lubricators, oil cans,
transfers, spanners,
taps and dies, draincocks
nuts and bolts etc.



Stationary Engines and Locos

- Orders welcome via
Website

Telephone or Email!



Polly Model Engineering
Unit 203 Via Gellia Mills,
Bonsall, Derbyshire,
DE4 2AJ, United Kingdom

www.polly-me.co.uk

Tel: +44 (0)115 9736700

Find us on 

sales@polly-me.co.uk